# Harvesting Energy

**An analysis of methods for increasing the use of forest and agricultural residues for biomass-based energy generation in Montana**

A Report to the 62nd Montana Legislature
October 2010

by Sonja Nowakowski and Hope Stockwell

Environmental Quality Council
2009-10 Interim

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**Environmental Quality Council members**



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This report is a summary of the work of the Environmental Quality Council, specific to the EQC's 2009-10 biomass study. Members received volumes of information and public testimony on the subject, and this report is an effort to highlight key information and the processes followed by the EQC in reaching its conclusions. To review additional information, including written minutes, exhibits, and audio minutes,
visit the EQC website:
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# Introduction

Biomass fuels provide about 3% of the energy used in the United States.[1] The possibility of expanding the biomass share of the energy mix, however, is huge—with Montana being one of several Western states with much to gain. With millions of acres of forest in need of management and cropland teeming with other potential biomass resources, Montana stands to see economic and environmental benefits as larger volumes of biomass are converted into electricity, heat, and liquid fuel, such as ethanol.

The Environmental Quality Council (EQC), in conducting its climate change study during the 2007-08 Interim, identified the expanded use of biomass feedstocks for energy use in Montana as a potentially important policy directive that deserved further evaluation and brought forward House Joint Resolution No. 1, included in **Appendix A**. The resolution identified specific issues, including funding alternatives for research and development, use of tax and loan incentives, use of pilot projects, documentation of emission impacts and mitigation, and the availability of biomass resources.

**The EQC, in conducting its climate change study during the 2007-08 Interim, identified the expanded use of biomass feedstocks for energy use in Montana as a potentially important policy directive that deserved further evaluation.**

The tasks assigned to the EQC and a brief summary of the EQC's responses are included in **Appendix B**. The EQC's findings and recommendations address the role the state can play in advancing biomass-based energy development in Montana. As a result of the study, the EQC requested staff develop one piece of draft legislation and a letter to Governor Schweitzer—both are included in **Appendix C**.

[1] http://www.energy.gov/energysources/bioenergy.htm

# Findings and Recommendations

## Findings:

✦Montana's private and public forests have the potential to make a substantial contribution to the production of heat, electricity, and transportation fuels. Sustainably produced biomass from these forests also contributes to long-term forest health by improving habitat and reducing catastrophic wildfires.

✦Investing in biomass can reduce wildfire risks and wildfire suppression costs; increase timber supplies; improve forest health; maintain forestry and agricultural jobs; and promote Montana's forest and agricultural industries.

✦Montana's State Forester and the Department of Natural Resources and Conservation should take specific actions to increase the utilization of forest biomass, particularly from federal lands within the state, but also from tribal, state, and private forests.

✦Recognizing that access to federal forest lands in Montana is critical to increasing biomass usage in the state and to promoting forest health and public safety, the State Forester and the Department of Natural Resources and Conservation should increase the state's participation in federal forest management decisions.

✦The Department of Natural Resources and Conservation is encouraged to use existing resources to develop a statewide inventory of dead and dying trees in Montana forests.

✦While the EQC recognizes the importance of air quality, some small portable forestry equipment should be exempt from air permitting requirements.

## Recommendations:

The EQC approved a letter that was sent to Governor Brian Schweitzer and one bill draft to be submitted to the 2011 Legislature for consideration:

✦LC 7000: Clarify the powers of Board of Environmental Review related to air quality permitting and rulemaking for forestry equipment.

✦Letter: Encourage Governor Schweitzer to continue support for Montana's Agricultural Research Stations and the work that is being done to promote biomass technologies.

# Background

Biomass includes both forest and agricultural residues—both are prevalent in Montana. Biomass can be a feedstock for both electricity and fuel—both opportunities are viable and being explored in Montana. HJR 1 notes that biomass for liquid fuel and for electricity are options worthy of discussion and review. The focus of the EQC's biomass study, however, largely revolves around the word "residues" or looking at opportunities to use materials that are leftover or not fully utilized. The information in this report does not include oilseed crushing facilities or operations that use annual crops as feedstock in Montana but instead focuses on projects that are utilizing woody biomass or agricultural residues, like straw and corn stalks. The study also largely focuses on biomass for heat and electricity, as opposed to biofuels.

Woody biomass users in Montana consume about 2.2 to 2.7 million dry tons of woody biomass a year, largely using mill residue to fuel the supply. Biomass users include 10 bark or wood pellet plants, Fuels for Schools facilities, two board facilities, and one pulp mill. A single facility, Smurfit-Stone Container Corp., accounted for more than one-half of the total annual biomass consumption in Montana.[2] That facility closed in early 2010.

**The focus of the EQC's biomass study largely revolves around the word "residues" or looking at opportunities to use materials that are leftover or not fully utilized.**

## Fuels for Schools Projects

The Montana Fuels for Schools and Beyond Program promotes the use of forest biomass waste for energy in public buildings—public schools in particular. It is a collaboration between the Montana Department of Natural Resources and Conservation (DNRC), the U.S. Forest Service, and Montana Resource Conservation and Development Areas. The 2001 National Fire Plan included grant money for pilot projects to demonstrate new methods of using small diameter and underutilized woody biomass and to facilitate development of technologies that use biomass.

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[2] "An Assessment of Forest-based Woody Biomass, Supply and Use in Montana," Todd Morgan, Bureau of Business and Economic Research, University of Montana, April 2009, page 18.

Funding for Fuels for Schools started in the fall of 2002. A breakdown of federal and general fund money used for the program is included in **Table 1**.

**The Montana Fuels for Schools and Beyond Program promotes the use of forest biomass waste for energy in public buildings—public schools in particular.**

The Fuels for Schools program works in three phases, with the end goal of using government grant money to make biomass a viable option.[3] The first phase is demonstration. For example, Darby Schools received the first system and was funded at a high level (100%). Dozens of tours were provided at the facility, and managers experimented with various fuels to gather information on improving the system. Additional demonstration projects were completed at Thompson Falls, Philipsburg, and Victor schools. In 2005, grants were awarded to demonstrate different applications of biomass heat. A maximum of $400,000 or 50% of construction and installation was provided. This led to the University of Montana-Western project in Dillon and projects in Troy, Townsend, and Kalispell.

**Table 1: Fuels for Schools Funding**

| Fuels for Schools Funding | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **Expenditures** | | | | | |
| | **Fiscal Year** | **2005** | **2006** | **2007** | **2008** | **2009** | **Totals** |
| **Federal** | Admin/ Operating | $34,436 | $42,601 | $4,207 | $43,197 | $68,709 | $193,150 |
| | Grants | $89,835 | $115,165 | $485,450 | $472,004 | $234,042 | $1,396,496 |
| | | | | | | | |
| **General Fund** | Admin/ Operating | 0 | 0 | 0 | $75,000 | $150,000 | $225,000 |
| | Grants | 0 | 0 | 0 | $100,000 | $175,000 | $275,000 |
| | | | | | | | |
| **Total Expenditures** | Admin/ Operating | $34,436 | $42,601 | $4,207 | $118,197 | $218,709 | $418,150 |
| | Grants | $89,835 | $115,165 | $485,657 | $572,004 | $409,042 | $1,671,496 |
| | | **$124,271** | **$157,766** | **$489,657** | **$690,201** | **$627,751** | **$2,089,646** |

*Source: Legislative Fiscal Division*

[3] http://dnrc.mt.gov/forestry/Assistance/Biomass/AboutProgram.asp

The $1.4 million UM-Western project, for example, was funded with a $400,000 grant administered by Headwaters Resource Conservation and Development. The DEQ State Energy Conservation Bond Program provided about $1 million through a 15-year low-interest loan.[4] The university initially had a contract with Sun Mountain Lumber in Deer Lodge to provide wood chips for about $3.25 per dekatherm, compared to the $8.68 per dekatherm paid for natural gas.[5] (That contract has since expired.)

The second phase of Fuels for Schools is expansion. In 2006, the DNRC offered a reduced level of support for projects, covering 25% to 35% . Eureka and Deer Lodge were recipients of those grants. Grants were used as an incentive to reduce the risks associated with adapting to an alternative system. The DNRC also is working to create "clusters or geographic groupings" of small biomass heating systems. Clustering can make the processing and delivery of wood fuel more economical and efficient. Using larger biomass projects for cogeneration of heat and power is also a concept explored through expansion. Finally, during the expansion phase the DNRC has systematically identified financial resources, beyond the Forest Service grants, to assist with biomass boiler installations. Funding includes resources such as rural development grants and low-interest loans, carbon offset funding, performance contracting with energy service companies, private foundation grants, and more.[6]

**Funding for biomass boiler installations includes resources such as rural development grants and low-interest loans, carbon offset funding, performance contracting with energy service companies, private foundation grants, and more.**

The DNRC is currently moving out of phase two and into phase three—privatization. With this move, grants are no longer available. The DNRC instead offers its support in the form of technical advice. The agency is working with the private and public sectors to identify funding sources, complete fuel supply assessments, network, and determine project feasibility. Program officials indicated that they moved into this phase largely because of a lack of grant funding. The program is operating on federal carryover money that is expected to run out in the

[4] *Dillon Tribune*, April 19, 2006, Page A-3.

[5] Ibid.

[6] http://dnrc.mt.gov/forestry/Assistance/Biomass/AboutProgram.asp

next 2 years. The program has used a combination of grants to complete projects but has not yet successfully completed a project without grant dollars from the Fuels for Schools program.

More than 50 prefeasibility assessments have been completed by the DNRC since the project's inception. DNRC also has done an overview analysis of boilers throughout Montana to focus on the top conversion opportunities. If sufficient grant money were available, between five and seven entities would likely initiate projects. The DNRC, to date, has not worked with entities interested in converting to biomass without grant support, because of the high up front costs associated with the systems and perceived risks associated with the technology.[7]

In Montana there are 10 Fuels for Schools projects, which have been funded in part with federal grant dollars. Projects are shown in **Table 2**. The largest project is at UM-Western and produces about 12 million British Thermal Unit's (MMBtu's) an hour and uses 3,800 green tons of wood waste each year. The smallest system is in Townsend, producing about 680,000 Btu's an hour.

**Figure 1: Transferring biomass bundles to chipper.** *Photo by Hope Stockwell.*

[7] Information provided by Angela Farr, DNRC, June 12, 2009 meeting.

**Table 2: Fuels for Schools Projects**

| Montana Fuels for Schools | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Facility** | **Square Footage** | **Project Cost** | **Peak Output BTU/hr** | **Annual Wood Fuel Use** | **Fuel Replaced** | **Estimated Annual Savings**[3] | **Date of Operation** |
| Darby Schools | 82,000 | $650,000[1] | 3 million | 760 tons | Fuel oil | $90,000 | 11/03 |
| Victor Schools | 47,000[2] | $590,000 | 4.9 million | 500 tons | Natural gas | $27,000 | 9/04 |
| Philipsburg Schools | 99,000 | $697,000 | 5.1 million | 400 tons | Natural gas | $52,000 | 1/05 |
| Thompson Falls Schools | 60,500 | $455,000 | 1.6 million | 400 tons | Fuel oil | $60,000 | 10/05 |
| Troy Schools | 33,235 | $299,000 | 1 million | 60 tons pellets | Fuel oil | $12,500 | 11/07 |
| Glacier High School | 220,000 | $525,000 | 6 million | 1,900 tons | New build | $100,000 | 4/07 |
| UM-Western | 471,370 | $1.4 million | 12 million | 3,800 tons | Natural gas | $118,000 | 2/07 |
| Townsend Schools | 120,000 | $425,000 | 680,000 | 250 tons pellets | Fuel oil, propane | $19,000 | 3/07 |
| Eureka Schools | 178,000 | $1.3 million | 4-5 million | 960 tons | Fuel oil, propane | $103,000 | 11/07 |
| Deer Lodge Elementary | 38,000 | $797,000 | 1.5 million | 700 tons | Natural gas | $48,000 | 10/08 |
| MT State Prison[4] | 40,000 | $990,000 | 3-5 million | 1,000 tons | Natural gas | $40,000 | 1/10 |
| **MT Total** | **1.4 million** | **$8.1 million** | | **~12,750 green tons** | | **$669,500** | |

*Information provided by DNRC*

[1] Projected numbers are provided for projects not yet completed. Darby cost excludes $268,000 for repairs to the existing heat distribution system.
[2] Victor's boiler is sized to heat an additional 1,600 sq. ft that will be built in the future—the tons consumed and savings are projected for the full heat load.
[3] Savings figures are based upon actual performance where available. Philipsburg's savings are estimated because they reduced the amount of heat required with additional weatherization.
[4] Project is underway.

## Private Projects

- **Smurfit-Stone Container Corp**.

Smurfit-Stone is an international company, with a plant in Frenchtown that was the biggest biomass energy user in Montana. The plant's main product was linerboard, which is a laminated paper stock used primarily in the manufacture of corrugated containers.

- Using biomass, 15 to 17 megawatts (MW) of electricity were generated at the site. Smurfit's manufacturing process provided an overview of maximizing wood products using biomass boilers and also illustrated the complexity of the process.
- A debarked tree goes through the chipping process. The resulting chips go through a digester or pressure cooker, which separates lignin from the wood fiber.
- The fiber is refined to make paper, while the remaining chemicals and lignin then go through a process to extract the turpentine and oils.
- The remaining "black liquor" is then fed into a recovery boiler, where it is sprayed through a fire to produce steam. The fire burns away the lignin and the inorganic chemicals drop to the bottom to be recovered for reuse.
- Bark and residue from processed pulpwood are also a source of biomass fuel for boilers.
- Steam from the boilers powers turbines, provides heat, and heats drums on the paper machines. [8]

Biomass consumption at the facility was about 948 green tons per day. The amount fluctuated based on season, moisture content, demand from the mill, and other factors. About 35% of the supply came from internal sources, including during chipping and a chip screening process. About 65% of the biomass that was used was purchased, with about 80% of that purchase coming from private landowner sources. Another 10% came from DNRC and state lands, and the final 10% was from Forest Service and Bureau of Land Management (BLM) sources. Smurfit often traveled as far as 200 miles away to procure materials. In January 2010 Smurfit-Stone permanently shut down.

[8] 2007 Environmental & Social Responsibility Report, Smurfit-Stone Container Corp.

- **AE Biofuels**

AE operates a cellulosic ethanol demonstration facility in Butte. The 9,000-square-foot commercial plant operates using feedstocks consisting of various grasses, wheat straw, corn, corn stalks, and sugar cane stalks. The $1.5 million facility is capable of producing 150,000 gallons of ethanol a year.

The plant uses a patented "Ambient Temperature Enzymes" process to convert starch and cellulose into fermentable sugars.[9] The technology used by AE Biofuels reduces energy use by:

- Combining the starch-to-sugar and sugar-to-alcohol steps
- Combining cellulosic and starch inputs to lower feedstock costs during distillation
- Using ambient air temperatures
- Eliminating cooking and cooling mash, like that needed for corn
- Reducing the cooling of fermentation.[10]

## Projects Proposed

Throughout Montana there are a number of ongoing discussions about the development of biomass energy projects. Those discussions are in varying stages. Cogeneration projects at Montana mills have been a major focus in biomass discussions, with specific projects as priorities if the Montana DNRC had received stimulus money through the U.S. Forest Service to assist with combined heat and power projects. The DNRC did not receive that federal funding; however, discussions about cogeneration projects continue.

The DNRC also has developed a map, included in **Appendix D**, that shows insect (bark beetle) infestations in the state in proximity to Fuels for Schools projects and open and closed mills in Montana. Included in **Appendix D** is a snapshot of potential projects on file with the DNRC. The

**Figure 2: Pitch tubes indicating beetle attack.** *Photo courtesy of the Colorado State University Extension*

[9] http://www.aebiofuels.com/butte_8_11_08.php

[10] http://www.aebiofuels.com/cellulosic_ethanol.php

information below focuses on the projects that have received the most attention in the last couple of years:

- **F.H. Stoltze Land & Lumber Co. in Columbia Falls**

Stoltze is investigating the development of up to 22 MW of generation capacity to replace the 100-year-old boilers at its Half Moon sawmill. The cogeneration plant would operate at about 12 MW an hour for half of the year and at 18 MW for the other half.[11] Development of the facility would be a $50 million investment and create about 13 jobs at the plant and 40 additional jobs for fuel collection, processing, and delivery. The cost of development is estimated at $2 million to $3 million per MW for the plant.

The byproducts from the operation at the plant and the 38,000 acres owned by Stoltze in the Flathead Valley would serve as the source for the facility. Electricity could potentially be sold to NorthWestern Energy, Flathead Electric Cooperative, or Lincoln Electric Cooperative.[12]

Chuck Roady, vice president and general manager, said the proposal pursued by Stoltze is based on a fuel source analysis of utilizing byproducts from the plant and from Stoltze timberlands but did not include fuel from national forest lands. Roady indicated the biggest obstacle to developing the project is the price of power. "You need a power agreement and financing," he said. "And you need that power supply agreement before you can get financing."[13]

- **Sun Mountain Lumber in Deer Lodge**

Sun Mountain is pursuing the development of 12 to 18 MW of generating capacity. This would be a $30 million to $50 million investment and create about 14 jobs at the plant and 20 to 40 additional jobs for fuel collection, processing, and delivery. Using byproducts at the plant, Sun Mountain could generate about 15 MW—as a general rule of thumb, it takes about 1 ton of biomass to generate 1 megawatt hour (MWh). Depending on chip prices, Sun Mountain also could get additional fiber from mills to the east and northeast.

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[11] *Flathead Beacon*, "Stoltze hopes to branch into alternative energy", Keriann Lynch, March 12, 2009.

[12] *Hungry Horse News*, "Stoltze seeks city support for co-gen plant", Heidi Desch, February 25, 2009.

[13] Interview with Chuck Roady, June 23, 2009.

Vast acres of beetle-kill in the area also could be a source for the facility. Nearby transmission lines and transportation corridors coupled with good air quality and development of the Mill Creek natural gas facility in nearby Anaconda are assets that increase the probability of development of the site.[14]

**Figure 3: Beetle-killed tree showing characteristic blue staining.** *Photo courtesy of the Colorado State University Extension*

Sun Mountain is engaged in an ongoing discussion with NorthWestern Energy about developing the plant. Sherman Anderson, owner of Sun Mountain Lumber, indicated the greatest obstacle to developing the cogeneration facility is the price of energy. "It's getting close, but it's just not at a point where we are willing to take the risk," Anderson said.[15] "It's kind of in limbo because of that—but it is strictly market."

Sun Mountain also currently supplies about 730 tons a year of fiber wood to fuel the Fuels for Schools project in Deer Lodge.

- **The Blackfoot-Clearwater Stewardship Project**

This project includes a renewable energy component that would build a biomass boiler and cogeneration facility at Pyramid Mountain Lumber in Seeley Lake. The Blackfoot-Clearwater Stewardship Project is a proposal developed by a wide variety of individuals and organizations aimed at restoring and protecting the landscape and stimulating rural economies and communities located within the Blackfoot and Seeley-Swan valleys.

The three-part proposal includes development of a $7 million public-private partnership with Pyramid Mountain Lumber to build a biomass boiler and energy facility that would use slash removal and other wood from private, state, and federal forest lands.

The proposal includes $3 million to cost-share for a new boiler (a 50/50 split) and $4 million to cost-share for the cogeneration facility (a 75/25 split, with the federal

[14] Interview with Sherman Anderson, June 23, 2009.

[15] Ibid.

government picking up 75% of the cost).[16] The 3.2 MW facility could add 20 to 30 jobs to the local economy.

Because of the project's relatively small size, nearly all of the power would be used by Pyramid Lumber, freeing up 3.2 MW that are currently purchased from Missoula Electric Cooperative. The plant would require about 100 tons a day of residuals, which could come from the mill. "But we would rather continue to sell off those products and utilize excess forest fuels as our feedstock for the facility," said Gordy Sanders, Pyramid's resource manager.

The biomass facility is one of three components included in the proposed stewardship project. The initiative, which would require Congressional approval and financial assistance, would develop new timber sales and forest management projects, certify wilderness areas, and establish travel trails. However, the three components are not interdependent, and each could move forward in different pieces of legislation.

## State Funding for Potential Projects

The 2009 Legislature approved a $475,000 appropriation in House Bill No. 645, the Montana Reinvestment Act, to the Department of Commerce to conduct a "biomass energy study". The funding was available to fund feasibility studies, installation of biomass energy boilers, or biomass program staff within the DNRC in order to increase biomass utilization. Based on EQC's direction at the May 2009 meeting, the EQC wrote Commerce Director Anthony Preite a letter, encouraging the Department to use the money for biomass pilot projects. A copy of the letter is included in **Appendix E**.

In late June 2009, Governor Brian Schweitzer announced that the $475,000 would be made available in the form of grants for biomass energy feasibility studies through the Department of Commerce. In July 2009 the Department solicited grant requests from applicants. Qualified applicants were required to use the money to prepare feasibility studies focused on assessing the potential for the development of woody biomass generation plants in Montana.

The feasibility studies include cost/benefit information to provide potential investors with sufficient information to determine the financial viability of a project, the potential public and private biomass supply in western Montana that could be used as feedstock, potential power that would be generated and transmission infrastructure, sustainability impacts, regulatory and permitting processes, National

[16] Interview with Gordy Sanders, July 1, 2009.

Environmental Policy Act (NEPA) and Montana Environmental Policy Act requirements, and a risk assessment. Private companies and consulting firms were invited to apply, and grant awards from $100,000 to $475,000 were offered.

The department received eight applications, with a review of the eight projects included in **Table 3**.

**Qualified applicants for Montana Reinvestment Act funds were required to use the money to prepare feasibility studies focused on assessing the potential for the development of woody biomass generation plants in Montana.**

Private companies and consulting firms were invited to apply, and the grant awards, announced in September 2009, included:

(a) $300,000 to Porter Bench Energy, LLC, to assist the company in developing multiple biomass plants in Montana. Porter Bench Energy has completed an initial review of biomass power generation potential in Lincoln and Flathead Counties. With this grant, they expanded their research to include the entire western part of Montana.

(b) $125,000 to NorthWestern Energy to enable the company to assess the feasibility of constructing up to eight biomass electricity plants throughout its service territory in Montana, concentrating on an area from the Flathead Valley through Missoula, Butte, and Big Timber. NorthWestern could potentially purchase or construct up to 200 MW of biomass electricity through this region and partnered with other entities to facilitate the study.

(c) $50,000 to the Montana DNRC to continue existing biomass programs.

The studies, complete by the spring of 2010, are the first step for developers working toward securing financing.

**Table 3: Biomass Grant Applications**

| Biomass Grant Applications | | |
|---|---|---|
| **Applicant** | **Project Description** | **$ Request** |
| Redleaf Consulting, PLLC | Biomass generation facility consisting of a Brayton cycle engine equipped with a fluidized biomass combustor and turbo generator. | None specified |
| McKinstry | 6-10 MW woody biomass generation facility for the City of Troy. | $175,000 |
| Porter Bench Energy, LLC | Multiple biomass plants in western Montana. | $475,000 |
| Stryker Wood Industries and Fuel Technologies | Plasma assisted gasification. | None specified |
| Montana Sustainable Building Systems | Cogeneration facility to provide heat and energy for a wood panel, beam, door and fiber insulation manufacturing facility to be located in Columbia Falls. | $145,000 |
| SouthEastern Montana Economic Development Corp. for ecoPHASER Energy | 36 MW combined heat and power plus a 12 MW nonfirm power congeneration facility at Ashland mill site. | $100,000 |
| Cooney Developments | Combined heat and power facility for the Bonner Mill Site. | $128,000 |
| NorthWestern Energy | Develop a business case for sustained biomass generation: A regional model for western Montana. | $210,460 |
| **Total*** | | **$1,233,460** |

*Two applicants did not specify a requested grant amount.

At the EQC's May 2010 meeting, members heard an overview of the feasibility studies prepared by NorthWestern Energy and Porter Bench Energy. NorthWestern Energy examined opportunities for biomass cogeneration at seven Montana sawmills. The company concluded that up to 200 MW of potential power could be added to its portfolio using biomass and prices could range from 7.9 cents per kilowatt hour (kwh) to 9.1 cents per kwh. The study also concluded that supply is not a constraining factor when cogeneration is added based on existing supply.

"Now it's time for business negotiations. This is a green light for negotiations to begin," according to the authors of NorthWestern's feasibility work.

Porter Bench Energy provided an equally optimistic overview of biomass opportunities in Montana. They examined opportunities for biomass facilities that were 60 MW in size, requiring an estimated $180 million in capital investments. Seventeen potential sites were identified as having the potential for biomass energy. Nine of those sites were examined more in-depth. Porter Bench looked at power purchase agreements with prices at 6.5 cents per kwh to 8.5 cents per kwh. To ease the financial risk of such endeavors, Porter Bench concluded that legislative mandates to purchase renewable energy credits for biomass are needed. Porter Bench Energy's presentation to the EQC is included in **Appendix F**.

## Recent Activities

In May 2009, several state agencies and the Western Governors' Association hosted the Montana Bioenergy Workshop in Missoula. The program was funded with support provided by the U.S. Department of Energy, U.S. Department of Labor, and the Energy Foundation. At the conclusion of the program, participants used the information provided to develop a series of recommendations to both Governor Schweitzer and the Montana Legislature.

The recommendations listed below are directly from the group and considered to be action items of the highest priority:

- Governor Schweitzer should promote forest management to mitigate wildfire, insects, and disease on both a state and national level. Access to federal land is a significant barrier in northwestern Montana but will ensure forests' survival and provide a reliable, firm source of renewable energy and reduce our carbon footprint. The scale and shape of bioenergy development must match the amount of material produced through environmentally sound, sustainable land management.

**At the conclusion of the program, participants used the information provided to develop a series of recommendations to both Governor Schweitzer and the Montana Legislature.**

- Collaboratively developed proposals for active management on Montana's national forests, such as the Beaverhead-Deerlodge Partnership and Blackfoot Clearwater Stewardship Proposals, should be legislatively authorized. It is recommended the Governor support these proposals and the continuation of Stewardship Contracting Authority, which allow national forests to bundle restoration projects with revenue-generating timber projects. The projects reduce dependency on appropriated dollars. Current authorization for Stewardship Contracting will expire in 2 years.

- ❑ The scale of cellulosic ethanol plants eligible for federal support should be revised to include smaller scale facilities. These projects can be smaller to remain sustainable and avoid excessive haul distances but can still be cost-effective.
- ❑ The state should coordinate cooperative grant applications to consolidate individual, small-scale efforts in order to reach the large scale required by federal programs. Doing so will be essential to continued rural development in Montana.

Development of a statewide, interagency bioenergy strategic plan to facilitate the development of bioenergy is recommended. This plan would:

- ❑ Quantify the state's biofuel potential resources and consider competing uses.
- ❑ Develop methods of enhancing supply assurance such as long-term contracts on state trust lands, assurance of supply in lieu of a tax credit, and pilot projects.
- ❑ Recommend policies that account for the state's feedstock variability.
- ❑ Identify cross-agency issues and opportunities to streamline the permitting process associated with new bioenergy projects.
- ❑ Take advantage of existing infrastructure such as existing transmission lines and opportunities for combined heat and power projects.
- ❑ Promote biomass by cofiring wood or agricultural residue at existing energy generating facilities where technically feasible.
- ❑ Lead by example. With flex-fuel vehicles as part of its fleet, the state can require that the vehicles that are capable of running on E85 do so when practical.

The group also recommends revisiting biomass incentives in Montana. Critical steps that need to be considered when structuring incentives for bioenergy include hauling, blending, producing, and the growing of feedstocks.

- ❑ Determine the potential import and export market for bioenergy and its byproducts. A study of the potentials would assist this industry.
- ❑ Account for water laws and potential restrictions.
- ❑ Various methods of supply assurance from long-term contracts on state trust land to assurance of state biomass supply in lieu of tax credits.

- ❑ The state should examine existing infrastructure for additional opportunities for combined heat and power (CHP) projects. This would include community-level distribution and require setting a proper value for the heat product.
- ❑ The state Renewable Portfolio Standard should be revised to recognize and allow that the cost of renewable power will be higher in the short run than traditional sources. Steps to encourage distributed generation would also encourage the development of rural and small-scale biomass projects.

Following up on the recommendations, an informal biomass working group has organized to look at biomass issues and advise the DNRC and the state forester. (The DNRC formed a similar work group several years ago but ended the program due to lack of participation.) The group includes the Department of Environmental Quality (DEQ), Department of Commerce, federal agencies, industry representatives, conservation organizations, and tribal representatives. There has been a great deal of interest in the group, and participation is increasing. A list of the working group members, who reported to the EQC in March 2010, is included in **Appendix G**. The report, including the working group's detailed recommendations to the EQC, is included in **Appendix H**.

# Montana's Current Biomass Incentives

There are a variety of biomass incentives currently in state law. The information provided below focuses on tax incentives, grant and loan programs, and regulatory systems in Montana that promote the use of biomass. Bonding opportunities for renewable resources, including biomass, are also included.

## Rules and Regulations

**Net metering**. Customers generating their own electricity using (but not limited to) wind, solar, geothermal, hydroelectric power, biomass, or fuel cells can participate in net metering. Regulated utilities must allow customers to participate, and some rural electric cooperatives also allow net metering. Neither NorthWestern nor MDU currently has net metering customers who use biomass. (Title 69, chapter 8, part 6, MCA)

**Utility Green Power Option**. NorthWestern Energy is required to offer customers the option of purchasing electricity generated by certified, environmentally preferred resources that include but are not limited to wind, solar, geothermal, and biomass. (69-8-210, MCA)

**Forest Service-Northern Region Woody Biomass Policy**. The policy requires that contractors doing work on federal lands delimb and deck all submerchantable tops that are brought to landings in whole-tree skidding operations to facilitate biomass removal and utilization.

**Renewable Portfolio Standard.** Discussed under the "Biomass Economics, Funding Mechanisms".

**Public Utility Regulatory Policies Act of 1978 (PURPA)**. The act establishes requirements for purchases and sales of electric power between qualifying small power production facilities and electric utilities under the regulation of the Public Service Commission (PSC). There are also federal rules implementing PURPA (18 CFR 292.101, et seq.) and state laws concerning small power production facilities. (Title 69, chapter 3, part 6, MCA) The "Energy Policy Act of 2005"addresses portions of the 1978 act with respect to net metering, time-based metering, and communications, interconnection, fuel sources, and fossil fuel generation efficiency.

## Tax Incentives

**Tax reduction:** All property of a biomass gasification facility and of biomass generation facilities up to 25 MW is class fourteen property taxed at 3% of its market value. (15-6-157, MCA)

**Tax exemption**: The appraised value of a capital investment in biomass combustion devices is exempt from taxation for 10 years on $20,000 in a single-family residential dwelling or $100,000 in a multifamily residential dwelling or nonresidential structure. (15-6-224, MCA)

**Property tax exemption:** New generating facilities built in Montana with a nameplate capacity of less than 1 MW and using alternative renewable energy sources are exempt from property taxes for 5 years after start of operation. (15-6-225, MCA)

**Property tax reduction:** Generating plants using alternative fuels that produce at least 1 MW are taxed at 50% of taxable value during the first 5 years after the construction permit is issued. (Title 15, chapter 24, part 14, MCA)

**Tax credit**: An income tax credit is provided for an individual taxpayer who installs in the taxpayer's principal dwelling an energy system using a recognized nonfossil form of energy generation. The credit may not exceed $500. (15-32-201, MCA)

**Property tax abatement for facilities**: An abatement from property taxation of a biomass gasification facility of 50% of its taxable value for the first 15 years after the facility commences operation is provided. Construction of the facility must have commenced after June 1, 2007. The total time may not exceed 19 years, and there are additional conditions. (Title 15, chapter 24, part 31, MCA)

**Tax credit:** An investment tax credit is provided to any individual, corporation, partnership, or small business corporation that makes an investment of $5,000 or more for a commercial system or net metering system that generates electricity by means of an alternative renewable resource. With certain limitations, a credit against individual or corporate income tax of up to 35% of the eligible costs of the system may be taken as a credit against taxes on taxable net income produced by certain specified activities related to alternative energy. If this tax credit is claimed, other related tax credits and property tax reductions may not apply. (15-32-402, MCA).

**Tax deduction for recycled materials:** Corporate income taxpayers may deduct an additional 10% of their business expenditures for the purchase of recycled material that was otherwise deductible by the taxpayer as a business-related expense in Montana. (15-32-610, MCA)

**Tax credit for property used to manufacture or process reclaimed materials**: Investments for depreciable property used primarily to collect or process reclaimable material or to manufacture a product from reclaimed material may receive a tax credit determined according to the following: (a) 25% of the cost of the property on the first $250,000 invested; (b) 15% of the cost of the property on the next $250,000 invested; and (c) 5% of the cost of the property on the next $500,000 invested. The tax credit may not be claimed for an investment in property used to produce direct energy from reclaimed material. (Title 15, chapter 32, part 6, MCA)

**Biolubricant production facility tax credit**: An individual, corporation, partnership, or small business corporation may receive a tax credit for the costs of investments in constructing or equipping a facility, or both, in Montana to be used for biolubricant production. Biolubricant means a commercial or industrial product used in place of petroleum-based lubricant that is composed, in whole or in a substantial part, of biological products, including forestry or agricultural materials. (15-32-701, MCA)

**Tax exemption:** A fuel user who produces less than 2,500 gallons annually of biodiesel using waste from vegetable oil feedstock and reports the production to the Department of Transportation is exempt from the special fuel tax. (15-70-320, MCA)

**Ethanol production tax incentive**: Distributors of ethanol that is produced in Montana from either (a) Montana wood products or (b) non-Montana agricultural products when Montana products are not available are eligible for this incentive. The tax incentive on ethanol is 20 cents a gallon for each gallon that is 100% produced from Montana products, with the amount of the tax incentive reduced proportionately to the amount of agricultural/wood product used that was not produced in Montana. (15-70-522, MCA)

## Grants, Loans, and Bonding

**Alternative energy revolving loan program**. Discussed under "Biomass Economics, Funding Mechanisms".

**Research and commercialization loans and grants**. The Board of Research and Commercialization Technology gives grants and loans for renewable resource research and development at institutions including universities and private laboratories. (Title 90, chapter 3, part 10, MCA)

**Renewable resource grant and loan program**. Discussed under "Biomass Economics, Funding Mechanisms".

**Microbusiness loan program**. Businesses that produce energy using alternative renewable energy resources, including biomass conversion, are eligible for microbusiness loans, which are capped at $100,000. A microbusiness is Montana-based and has fewer than 10 full-time employees with gross annual revenue of less than $1 million. (Title 17, chapter 6, part 4, MCA)

**Economic development bonds.** Energy projects (or natural resource development in terms of biomass) are often eligible for economic development bonding via the Board of Investments. (Title 17, chapter 5, part 15, MCA)

**Clean Renewable Energy bonding**. Local government bodies and tribal governments are authorized to participate as qualified issuers or qualified borrowers under the federal Energy Tax Incentives Act of 2005 to better access financial investments for community renewable energy projects or alternative renewable energy source. (Title 90, chapter 4, part 12, MCA)

# Biomass Incentives in Other States

States have implemented a number of policies and incentives in recent years to encourage the use of biomass. This includes broader efforts related to renewable energy sources, forest management, and energy conservation and policies specifically tailored to biomass. Those policies aim to improve local utilization, to reduce costs associated with harvesting, handling, and transporting biomass, and to develop manufacturing and consumer markets.

Approaches used by states range from transportation credits paid on the volume of wood chips transported to an energy plant, to reduction in vehicle tags, and taxes, and consumer credits for purchase of biomass products.[17] There are cost-share, grant, loan, rebate, and training programs, as well as various tax credits ranging from reduction of or exemption from sales tax to deductions or exemptions from corporate, production, personal, and property taxes.

**Approaches used by states range from transportation credits paid on the volume of wood chips transported to an energy plant, to reduction in vehicle tags, and taxes, and consumer credits for purchase of biomass products.**

Oregon's tax credit is hailed by Bill Carlson of Carlson Small Power Consultants as the best state tax incentive because a number of different entities may use the credit. Carlson is involved with the development of several biomass-fueled projects at forest product sites across the Western United States. He has conducted biomass feasability studies for several sawmills in Montana and spoke at the Montana Bioenergy Workshop in Missoula.

The following is a categorized review of other states' incentives as compiled from the National Conference of State Legislatures and "State Woody Biomass Utilization Policies," published in December 2008 by Dennis R. Becker and Christine Lee at the University of Minnesota.

[17] State Woody Biomass Utilization Policies, University of Minnesota, College of Food, Agricultural and Natural Resource Sciences, Department of Forest Resources, Becker, Dennis R. and Christine Lee, December 2008.

# Tax Incentives

## Oregon

Enacted in 2007, Oregon provides business tax credits to support the production, collection, and use of biomass and biofuels. The program is administered through an income tax credit for producers and collectors of Oregon-sourced biomass or energy crops based upon volume. Producers of neat ethanol or pure bio-oils from Oregon feedstock are also eligible.

**Credit Amount:**

- oil seed crops, $0.05 per pound
- grain crops, including but not limited to wheat, barley and triticale, $0.90 per bushel (grains do not include corn; wheat became eligible January 1, 2009)
- virgin oil or alcohol $0.10 per gallon
- used cooking oil or waste grease, $0.10 per gallon
- wastewater biosolids, $10.00 per wet ton
- woody biomass collected from nursery, orchard, agricultural, forest, or rangeland property, including but not limited to pruning, thinning, plantation rotations, log landing, or slash resulting from harvest or forest health stewardship, $10.00 per green ton
- grass, wheat, straw, or other vegetative biomass from agricultural crops, $10.00 per green ton
- yard debris and municipally generated food waste, $5.00 per wet ton
- animal manure or rendering offal, $5.00 per wet ton

**Who's Eligible:**

An agricultural producer or a biomass collector operating as a trade or business that pays taxes for a business site. The business, its partners, or its shareholders may use the credit. The applicant must be the producer or collector of the biomass in Oregon that is delivered to a bioenergy facility in Oregon for use as an energy fuel. An agricultural producer means a person that produces biomass that is used in Oregon as biofuel or to produce biofuel. A biomass collector means a person that collects biomass to be used in Oregon as biofuel or to produce biofuel. The producer or collector also can be an Oregon nonprofit organization, tribe, or public entity that partners with an Oregon business or resident who has an Oregon tax liability.

## Arkansas

HB 2256 (2009) exempts biomass primarily used for biofuels production from the state's natural resources severance tax. For example, timber is otherwise taxed 17.8 cents per ton for pine and 12.5 cents per ton for all other timber.

**California**
In 2007, California exempted fuel used to transport biomass from state sales and use tax.

**Idaho**
Under the Biofuel Fueling Infrastructure Tax Credit (2007), qualified biofuel fueling infrastructure is eligible for a credit of up to 6% of the qualified investment against the corporate income tax. The allowable credit cannot exceed 50% of the income tax liability of the taxpayer.

**Kentucky**
The Railroad Expansion Tax Credit (2009) provides a tax credit worth 25% (up to $1 million) of the cost incurred by corporations or railway companies to expand or upgrade rail facilities to transport biomass resources.

**Mississippi**
S 3278 (2009) provides that an enterprise owning or operating a facility producing electricity through the firing or cofiring of biomass is allowed an annual investment tax credit equal to 5% of investments made by the enterprise in the initial establishment of an eligible facility. Any tax credit claimed but not used in any taxable year may be carried forward for five consecutive years from the close of the tax year in which the credits were earned. The credit that may be utilized in a tax year is limited to an amount not greater than 50% of the total state income tax liability of the enterprise for that year generated by, or arising from, the facility.

**New Mexico**

- **Renewable Energy Production Tax Credit (enacted 2002, amended 2007)** originally provided a tax credit against corporate income taxes of one cent per kilowatt-hour ($0.01/kwh) for companies that generate electricity from wind or biomass. The credit may be applied annually to the first 400,000 MWhs of each year for 10 years (i.e. $4,000,000/year). The Renewable Energy Production Tax Credit was extended in 2007 to apply to personal income taxes for companies that generate electricity from wind or biomass using the same formula for corporate income taxes. Total generation from both the corporate and personal tax credit programs combined must not exceed 2 million MWhs of production annually.
- **Biomass Equipment and Materials Deduction (2005)** allows businesses to deduct the value of biomass equipment and biomass materials used for the processing of biopower, biofuels, or biobased products when determining the Compensating Tax due. The rate is 5% of the value of the property or service. Compensating Tax is designed to protect New Mexico businesses from unfair competition from out-of-state business not subject to a sales or

gross receipts tax. This biomass Compensating Tax deduction is analogous to a sales tax exemption for renewable energy equipment available in some other states.

- **Alternative Energy Manufacturer's Tax Credit (2006)** allows manufacturers of alternative energy products and components to receive a tax rebate. The credit is limited to 5% of the taxpayer's qualified expenditures, such as manufacturing equipment. Any remaining portion of the tax credit can be carried forward for up to 5 years.

**South Carolina**

The Biomass Energy Production Incentive (2007) is part of South Carolina's Energy Freedom and Rural Development Act, which provides production incentives for certain biomass-energy facilities. Eligible systems earn $.01 per kwh for electricity generated and $.30 per therm (100,000 Btu) for energy produced from biomass resources. The incentive payment for the production of electricity or thermal energy may not be claimed for both electricity and energy produced from the same biomass resource. The incentive payment may be claimed as a tax credit or received in cash.

## Other Monetary Incentives

**Alabama**

The Biomass Energy Program (Alabama Department of Economic and Community Affairs) assists businesses in installing biomass energy systems. Program participants receive up to $75,000 in interest subsidy payments to help defray the interest expense on loans to install approved biomass projects. Technical assistance is also available through the program.

**Colorado**

Community Biomass for Thermal Usage Program (Governor's Energy Office) $100,000 has been allocated for this program from the Colorado Clean Energy Fund. The purpose of this partnership program is to provide financial support for biomass-heating projects that utilize community-based biomass sources. Financial support from multiple stakeholders must be committed before a project can receive additional funding through the program. Priority is given to projects that use community-produced wood chips or Colorado-manufactured pellets. High priority is given to projects that "include supply from fuel reduction, restoration activities, local collection sites, and/or projects that demonstrate long term availability of biomass supply."

**Florida**
The Farm to Fuel Grants Program (2007) provides matching grants for demonstration, commercialization, and research and development projects related to bioenergy. As part of the program, the Legislature appropriated $25 million in matching grants. It is intended to stimulate investment in energy projects that produce bioenergy from Florida-grown crops or biomass.

**Idaho**
The Biofuels Infrastructure Grant (2007) provides grants for up to 50% of the cost of the project for retail fuel dealers who choose to invest in qualified fueling infrastructure projects dedicated to providing biofuels to customers. Funds can be used for installing new fueling infrastructure or for upgrading existing infrastructure documented as being incompatible with biofuels, including cleaning existing storage tanks.

**Illinois**
The Biogas and Biomass to Energy Grant Program (1997) focuses on demonstrating the use of biogas and biomass for onsite energy generation at facilities in Illinois. The biogas and biomass grant program will provide a 50% cost-share for energy feasibility studies or for the installation of equipment for these purposes.

**Vermont**
Biomass Electricity Production Incentive (2004, nonlegislative) Central Vermont Public Service Corporation (CVPS), Vermont's largest electric utility, offers a production incentive to farmers who own systems utilizing anaerobic digestion of agricultural products, byproducts, or wastes to generate electricity. CVPS purchases electricity and renewable energy credits at 95% of the Locational Marginal Price of generation published by ISO New England (roughly avoided cost), plus an additional $0.04 per kwh. CVPS sells the renewable energy credits generated under this arrangement as part of CVPS Cow Power, the utility's green power program. This program offers customers the opportunity to purchase renewable energy for $0.04 per kwh above the retail cost of electricity.

**Virginia**
Code Section 45.1-394 (2009) provides that a producer of at least one million gallons of "advanced" biofuels derived from renewable biomass or algae may receive a production incentive grant equal to $0.125/gallon sold in the calendar year (equals at least $125,000/year).

## Nonmonetary Policies/Incentives

**California**

Biofuels Production Mandate and Alternative Fuel Use Study (Executive Order S-06-06) California plans to use biomass resources to provide transportation fuels and electricity to satisfy California's fuel and energy needs. To increase the use of biomass in fuel production, the state will produce its own biofuels at a minimum of 20% by 2010, 40% by 2020, and 75% by 2050. The Bioenergy Action Plan includes: research and development of commercially viable biofuels production and advanced biomass conversion technologies; evaluation of the potential for biofuels to provide a clean, renewable source for hydrogen fuel; and increases in the purchase of flexible-fuel vehicles to 50% of total new vehicles purchased by state agencies by 2010.

**North Carolina**

Biomass Market Development for North Carolina (2005) The State Energy Office (SEO) will facilitate permanent establishment of the North Carolina Biomass Council (NCBC) through a subcontract with the North Carolina Solar Center (NCSC). The Council will provide consultation to the North Carolina Energy Policy Council, the SEO, and the North Carolina General Assembly on implementation of bioenergy studies and demonstration projects through the establishment of a biomass deployment roadmap for North Carolina. A biomass waste exchange website will be created, launched, and marketed, dedicated to listing and trading biomass wastes and other biomass products.[18]

**Virginia**

- **Code Section 15.2-2288.01 (2009)** provides that local governing bodies may not require a special use permit for certain small-scale conversion of biomass to alternative fuel if at least 50% of the feedstock is produced either onsite or by the owner of the conversion equipment, the structure used to process the feedstock occupies less than 4,000 square feet, not including space for feedstock storage, and the owner of the farm notifies the administrative head of the locality in which the processing occurs.
- **Code Section 10.1-1308.1 (2009)** provides that a proposed "qualified energy generator" that would generate or produce no more than 5 MW of electricity from biomass must receive an expedited permitting process from

[18] According to North Carolina Department of Commerce Energy Office Renewable Program Manager Bob Leker, the agency was unable to effectively sustain an exclusive biomass waste exchange website. Biomass exchange is now included in a separate website for plain waste exchange.

the Air Pollution Control Board not to exceed 60 days. The permit application fee may not exceed $50.

## Federal Biomass Activities

There are more than 30 bills before Congress that in some way deal with the issue of biomass. Those bills range from loans for cellulosic ethanol production technology development to amending the Clean Air Act to change and expand the current definition of renewable biomass. During the September 2009 EQC meeting, members received an overview of federal activities, which is included in **Appendix I**. Throughout the interim, the EQC was updated on federal activities. The issues are evolving daily, making it difficult to keep on top of the multiple pieces of legislation. Below is a brief snapshot of federal legislation that has received significant attention in the past months.

- **American Clean Energy and Security Act (H.R. 2454) and the American Power Act** The version of the bill approved by the House was sent to the Senate Environment and Public Works Committee. The bill did not include an eligible list of carbon offset projects or improvements to the biomass definition that several biomass supporters were seeking. The Senate bill is similar to H.R. 2454 but includes many changes to the cap and trade concept. "Recognition of the carbon neutrality of biomass is critical for our industry under a comprehensive cap and trade scheme as biomass-derived fuels will not count against the carbon emissions cap for regulated entities," according to the Biomass Thermal Energy Council, of which the Montana DNRC is a member.[19]
- **Appropriations** The Senate has approved a $34.3 billion energy and water spending bill that funds the Energy Department, the Army Corps of Engineers' water projects, the Interior Department's Bureau of Reclamation, and several other independent agencies. The Senate bill provides almost $27.4 billion for the Department of Energy. Differences between H.R. 3183, approved in July 2009, and the Senate version will be worked out in conference committee. The Senate version includes an amendment that appropriates $15 million into district energy and combined heat and power systems. The amendment authorizes technical assistance grants from the Department of Energy to parties including utilities, universities, and local governments. The grants would be used for engineering and feasibility studies, design work, and analysis to overcome financial, permitting, and other barriers.

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[19] http://www.biomassthermal.org/

- **H.R.622** To amend the Internal Revenue Code of 1986 to expand the credit for renewable electricity production to include electricity produced from biomass for onsite use. Sponsor: Rep. Michael Michaud; Latest Action: Referred to the House Ways and Means Committee.
- **H.R.1111** To promote as a renewable energy source the use of biomass removed from forest lands in connection with hazardous fuel reduction projects on certain federal land and for other purposes. Sponsor: Rep. Denny Rehberg; Latest Action: Referred to the House Energy and Commerce Committee.
- **S. 1470** To sustain the economic development and recreational use of national forest system land and other public land in the State of Montana, to add certain land to the National Wilderness Preservation System, to release certain wilderness study areas, to designate new areas for recreation, and for other purposes. Biomass provisions are included in Section 105 and require an extensive biomass feasibility study. Sponsor: Sen. Jon Tester; Latest Action: Hearings held in Senate Energy and Natural Resources Subcommittee on Public Lands and Forests.
- **The 2008 Farm Bill** provides financial assistance to producers who deliver eligible material to biomass conversion facilities. The Farm Service Agency will provide financial assistance to collect, harvest, store, and transport eligible materials. Once an agreement is signed between the FSA and a facility and funding through the program is provided, the facilities can begin accepting materials. Producers who sell these materials can apply for matching payments under collection, harvest, storage, and transportation. Biomass conversion facilities may become "qualified" by submitting a Memorandum of Understanding to FSA state offices. For example, if a qualified biomass conversion facility pays a producer $30 per dry ton for biomass, the material owner or producer would be eligible for a matching payment of $30 per dry ton from FSA.

The federal Biomass Crop Assistance Program (BCAP) noted above has received a great deal of attention in 2010. Authorized by the 2008 Farm Bill, BCAP provides financial assistance ($1 per $1 paid per ton) to entities that take eligible biomass to designated conversion facilities where it is used as heat, power, biobased products, or biofuels. Assistance was provided for Collection, Harvest, Storage, and Transportation (CHST) costs related to the delivery of the material. In early 2010 the federal government froze payments and sought a rule clarification for the program. Payments were suspended because CHST funds were being used to pay for products that included residuals from wood product plants, like sawdust. The funds were then increasing prices and competition for markets already in place, such as the fiberboard industry.[20] The intent of BCAP was to appeal to the industry to clear away debris that had little or no existing market value.

The federal government is looking at a new rule that prohibits the use of residue that already can be used for higher-value products. In Montana 22 BCAP contracts for a total of $981,343 were in place as of April 2010, according to the USDA Farm Service Agency.

There also has been a flurry of activity related to federal funding for potential biomass activities. For example, in January 2010, the U.S. Department of Agriculture announced it would provide $20 million to accelerate efforts to fight mountain pine beetle infestation in Montana. The $20 million could initially provide for forest management and conservation programs in Montana. It hasn't been determined how much each of the state's 10 forests will receive. In late 2009 the Collaborative Forest Landscape Restoration Project was announced with funding authority through 2019. The project includes the goal of using forestry byproducts. Up to $8 million a year should be available for projects on national forest lands in each U.S. Forest Service region.

[20] *Biomass Magazine*, "BCAP Rule Revision," Anna Austin, April 2010.

# Biomass Economics, Funding Mechanisms

## Tax Incentives

The Montana Legislature has enacted a number of funding mechanisms in the form of tax incentives to promote the use of biomass. Those tax incentives are listed earlier in this report. The DNRC also provided the following example of the tax credits use for a potential biomass project: "If a mill installs a system for electrical generation from biomass, and sells a portion of that energy, only the income from selling the energy is subject to the 35% tax credit on the investment in the biomass generating system. In most cases, this is not much of an incentive, because biomass energy investments do not generate high profits or cash flow." In only a few cases would an entity be able to take full advantage of the tax credit because of the limited taxable income generated by a biomass energy investment.

Oregon offers a 50% investment tax credit for renewable energy installations, credited over 5 years at 10% per year. Oregon's credit also is applied to all income by a taxpayer on a consolidated return, not just the income generated by the investment. Entities that install systems that can't use the credit (nonprofits or entities without tax liability) can sell the credit at a discount to other taxpayers. That ability has been used as equity for borrowing capital for the original investment. "Montana's 35% would not necessarily need to be modified to 50%, but allowing the credit to apply to all income, or to be sold at a discount, would make the credit much more powerful," the DNRC noted.

The 2009 Legislature also contemplated an income tax credit for removing and processing biomass for energy, similar to an Oregon law discussed previously in this report (H.B. 2210). In general, it provides a $10 per green ton state income tax credit for the removal and use of biomass for energy. The credit is available to the entity that removes and processes the material. It also can be sold at a discount to an eligible taxpayer if the biomass producer is not able to use it. In Montana, Senate Bill No. 146, requested by the 2007-08 Fire Suppression Committee, would have provided a similar credit against individual income or corporate income taxes for biomass collection or production. The bill was tabled in Senate Taxation during the 2009 legislative session. S.B. 146 and its fiscal note are included in **Appendix J**.

It is noteworthy that many of the tax credits and exemptions for biomass facilities and biofuel operations have not been well utilized in Montana. In the summer of 2009, staff visited with a number of developers who are investigating biomass facilities around the state. Staff inquired about financial obstacles and potential incentives. Developers largely identified two key issues as the most significant barriers:

(a) the price of power and electricity markets; and

(b) uncertainty about long-term supply, particularly where federal land is concerned.

## Grants and Loans

H.J. 1 requires the EQC to look specifically at the alternative energy revolving loan program and the renewable resource grant and loan program.

> **Developers largely identified two key issues as the most significant barriers: the price of power and electricity markets; and uncertainty about long-term supply, particularly where federal land is concerned.**

The Renewable Resource Grant and Loan (RRGL) program (Title 85, chapter 1, part 6, MCA) provides grants and loans to promote the conservation, management, development, and preservation of Montana's renewable resources. Administered by the DNRC, the program provides funding for public facility and other renewable resource projects. Numerous public facility projects including drinking water, wastewater, and solid waste development and improvement projects have received funding. Other renewable resource projects that have been funded include irrigation rehabilitation, dam repair, soil and water conservation, and forest enhancement. In October 2009 the DNRC provided a memo to EQC staff discussing use of the program for biomass. The memo is included in **Appendix K**.

The program may fund any government agency project that conserves, improves management of preserves, or develops a renewable resource. Eligible applicants include state agencies, school districts, universities, counties, incorporated cities and towns, conservation districts, irrigation districts, water/sewer/solid waste districts, and tribes. The majority of projects funded are water resource projects, but forestry, soil conservation, renewable energy, and recreation have received past funding.

The RRGL program provides up to $100,000, noncompetitive first-come, first-served planning grants (up to $20,000 for a preliminary engineering report) and low-interest loans with terms set by the Legislature. Loans are only for an amount based on an entity's ability to pay. Between May and September of 2009, the DNRC distributed about $1 million in planning grants.

The RRGL program is funded with resource extraction taxes, including interest earnings from the Resource Indemnity Trust and portions of the Resource Indemnity and Ground water Assessment Tax, the Oil and Gas Assessment Tax, and the Metalliferous Mines Tax. The revenue sources are currently volatile, and about $5 million is expected to be available for the grants in 2011. During the 2009 Legislature, the RRGL budget was supplemented with House Bill No. 645—the Montana Reinvestment Act or implementation of the federal American Recovery and Reinvestment Act of 2009 (ARRA) funding, and all projects were funded.

Grants and loans are approved by the Legislature. The DNRC evaluates and scores applications based on statutory requirements and current legislative initiatives. (The deadline for an application is May 15 of every even-numbered year.) Typically, funds are available for 50% to 75% of the applicants. The rankings, based on scores, are presented by the Governor in Volume 6 of the executive budget. Projects and rankings are considered by the Joint Long-Range Planning Committee, House Appropriations Committee, and the Senate Finance and Claims Committee. The Legislature and the Governor approve funding and ranking of the projects in House Bill No. 6. Grants are then available starting July 1 following the legislative session.

The program is designed to potentially accommodate biomass projects; however, developers simply have not used the program in the past, according to the DNRC. The Resource Development Bureau of the DNRC is working with the Forestry Division and a school district to develop grant applications for the 2010 funding cycle.

The DNRC identified four impediments to potential project sponsors, focused specifically on deterrents to the use of the grants for biofuels projects.

- The span of time between an applicant's project idea and available funding is too long. Grants are currently approved once every 2 years. Many project sponsors need funding within 6 months of initiating a project.
- The project grant application is too complex to be easily completed. Because of the need to objectively score each project and the challenge of comparing and ranking a broad array of projects, a complex application is required. If the RRGL could guarantee funding, the application could be a simple statement of eligibility qualifications. The DNRC recently initiated a planning grant program that distributes funds based only on eligibility. The program has helped entities better define projects and submit good applications.

- Nongovernment entities, like private foresters and wood processing plants, are not eligible for RRGL funding. To overcome this issue in the past, nongovernmental entities have teamed with government partners to seek grants from the RRGL program.
- The $100,000 cap for grants is inadequate for some projects. Most of the projects that receive RRGL funding receive grants and loans from multiple sources. A funding package that includes five to six sources is not unusual.[21]

The Alternative Energy Revolving Loan program (75-25-101, MCA) provides loans to individuals, small businesses, units of local government, units of the university system, and nonprofit organizations to install alternative energy systems that generate energy for their own use or for capital investments for energy conservation purposes when done in conjunction with alternative energy systems. The program is funded with air quality penalties collected by the DEQ. Loans up to a maximum of $40,000 must be repaid within 10 years. The rate for 2009 is 3.5%. If loans are made by the DEQ using stimulus money received through ARRA, loans of up to $100,000 with a 15 year payback may be available.

In Fiscal Year 2008 the alternative energy loan program received 31 applications and 26 projects were financed for a total of $719,674. Two applications were withdrawn by the applicants, two were declined for financial reasons, and the remaining application was processed in Fiscal Year 2009. The 2008 loans also represented the broadest range of technologies included in the portfolio to date—including biomass or pellet stoves. The loans have largely been used for solar electric systems, 47%. Biomass has been represented in about 5% of the projects.

The Alternative Energy Revolving Loan program allows loans for low-emission wood or biomass combustion device as defined under 15-32-102, MCA:

"Low-emission wood or biomass combustion device" means:

(a) a wood-burning appliance that is:

(i) certified by the Environmental Protection Agency (EPA) pursuant to 40 CFR 60.533; or

(ii) qualified for the phase 2 white tag under the EPA [Method 28 Outdoor Wood-fired Hydronic Heater requirements];

(b) an appliance that uses wood pellets as its primary source of fuel; or

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[21] "Use of the Renewable Resource Grant Program to Support Biofuels Projects" Memo to EQC staff from Alice Stanley, Chief Resource Development Bureau, DNRC, October 13, 2009.

(c) a masonry heater constructed or installed in compliance with the requirements for masonry heaters in the International Residential Code for One- and Two-Family Dwellings.

The definition is used to ensure that projects funded with public funds meet environmental standards for air quality. Biomass projects to date have all been for residential heating equipment. Pellet stoves, masonry stoves, and outdoor boilers have been the most common projects. Businesses also could apply, but none have to date. The loan amount of $40,000 limits the size of projects. Funding for the program from air quality penalty fees will be fully subscribed by December 2009. At that time, the amount of funds for loans will be reduced to the amount of money revolving back to the program and future air quality penalties, according to the DEQ.

DEQ has been working with the Department of Energy (DOE) to get approval to include biomass projects under the ARRA funding for the loan program. Initially, DEQ excluded biomass from the ARRA-funded program because the DOE was requiring NEPA review and could not provide guidance on the extent of that review. DEQ now has verbal approval from DOE on the type of review needed and expects that biomass projects will be eligible for loans. About $1.2 million in ARRA funding for loans will be available in early 2010.

The 2009 Legislature also appropriated $1 million in ARRA money for grants for renewable energy development in Montana. The grants are being directed toward projects that have completed research and are in production but are still new or developing technologies in Montana. The grant amount may be up to $500,000 for a single application. As part of the renewable energy grant and loan program, the DEQ also shares information with consumers and businesses about the tax benefits of installing renewable systems. Technical assistance is also provided to small-scale (less than 100 kW) systems using solar, wind, fuel cells, microturbines, and geothermal resources for self-generation, net metering, or water and space heating.

The 2009 Legislature has taken steps to fund research and development, in the form of feasibility study grants for biomass projects. The 2009 Legislature approved a $475,000 appropriation in House Bill No. 645, the Montana Reinvestment Act, to the Department of Commerce to conduct a "biomass energy study". The department awarded the money to entities for feasibility grants, as discussed previously in this report.

## Power Prices, Regulation, and Electricity Markets

The costs of biomass-based electricity generation can vary depending on the technologies used at the facility, fuel costs, fuel types, and transportation costs. At the low end of the price spectrum are biomass facilities located at sites where the fuel is already there, like lumber mills, and is of no cost or is a gain because it avoids disposal costs. Siting plants at mills also allows developers to utilize the heat generated during electricity generation. Steam produced in a biomass boiler can both generate electricity and provide heat needed in industrial processes. Mills also have the infrastructure needed to process woody biomass.

On the other end of the spectrum are generation facilities that have to access a fuel supply, transport it, and process it for electricity. Biomass fuel costs range from $0 to $5 per MMBtu. Generating electricity using biomass also requires large amounts of residues. Facilities that can accommodate various fuel types may be better positioned to respond to supply uncertainty. If cogeneration is used at a facility, steam can be sold to an industrial user to offset the cost of producing electricity.

Combined heat and power at mills is typically more efficient and captures more energy value than electricity alone. Projects producing heat alone are anywhere between 70% and 80% efficient, depending on the technology, according to DNRC estimates. Electricity alone is estimated to be 25% to 35% efficient. Combined heat and power, depending on the amount of waste heat used, can be 45% to 90% efficient. Some Montana projects at area mills have examined sizing biomass development larger than their waste heat load to capture a better economy of scale or return on the investment in energy generating equipment. That results in an estimated 45% to 50% efficiency in overall energy recovery. Sizing projects to match waste heat load is an option, but proportionally the electricity is then more costly.

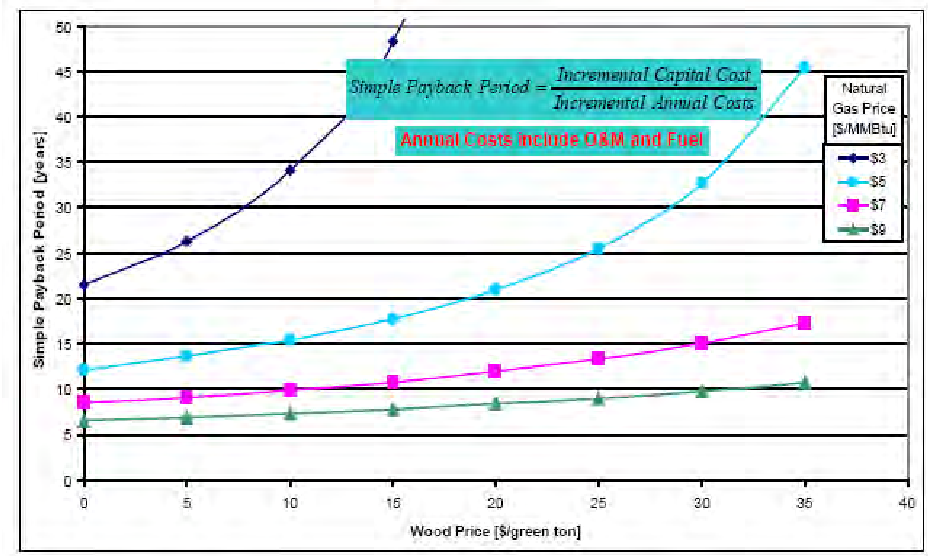


**Figure 4: Payback for Biomass.**
*Source: National Renewable Energy Laboratory, DOE*

Project economics are impacted not only by the cost of the fuel but also by the price of the lowest-price fossil fuel alternative, such as natural gas.[22] **Figure 4**, produced by the National Renewable Energy Laboratory, puts the numbers into perspective. The table shows the payback period for a 3 Mbtu/hr system with a total installed capital cost of $850,000. If wood is $15/ton and natural gas is $7/MMbtu, for example, the payback term is 11 years. If wood is $15/ton and natural gas is $3/MMbtu, the payback is about 48 years. Because the unit cost of heat from biomass ($/Btu) is generally far lower than the cost of the fossil fuel it replaces, the savings add up faster for larger heat users. **Table 4** shows a comparison of the cost of various fuels per MMbtu of energy produced.

**Table 4: Cost Comparison of Fuels per Mbtu**

| Source | Units | Cost to User per unit ($ U.S.) | Efficiency | Btu/unit | $ per Mbtu |
|---|---|---|---|---|---|
| Chipped biomass | $/green ton | $50.00 | 75% | 13,500,000 | $4.94 |
| Wheat straw bales | $/ton | $55.00 | 70% | 14,000,000 | $5.61 |
| Natural gas | $/therm | $0.50 | 85% | 100,000 | $5.88 |
| Wood/ag pellets | $/ton | $130.00 | 80% | 15,000,000 | $10.83 |
| Natural gas | $/therm | $1.00 | 85% | 100,000 | $11.76 |
| Wood/ag pellets | $/ton | $160.00 | 80% | 15,000,000 | $13.33 |
| Hardwood pellets | $/ton | $185.00 | 80% | 16,600,000 | $13.93 |
| Natural gas | $/therm | $1.50 | 85% | 100,000 | $17.65 |
| Fuel oil | $/gallon | $2.25 | 85% | 135,000 | $19.61 |
| Natural gas | $/therm | $1.75 | 85% | 100,000 | $20.59 |
| Propane | $/gallon | $2.25 | 85% | 91,600 | $28.90 |
| Electricity | $/kWh | $0.10 | 100% | 3,413 | $29.30 |

*Source: National Renewable Energy Laboratory, DOE*

Estimates in Oregon and the Pacific Northwest show the cost to generate electricity from biomass ranges from 5.2 to 6.7 cents per kwh, using conventional combustion technology without cogeneration. In contrast, the estimated cost of generating electricity from a new natural gas-fired, combined-cycle power plant is 2.8 cents per kwh.[23] However, the use of fossil-fuel resources versus renewable resources may be closely linked to potential federal climate change activities and restraints on carbon dioxide emissions. The impact of potential climate change activities on the future

[22] "Market Assessment of Biomass Gasification and Combustion Technology for small-and-medium-scale applications", National Renewable Energy Laboratory, Scott Haase and David Peterson, July 2009.

[23] Oregon Biomass Coordination Group, http://www.oregon.gov/ENERGY/RENEW/Biomass/Cost.shtml

price of fossil-fuel generation is uncertain at this time. It is possible that if federal legislation is enacted that both requires a national renewable portfolio standard and puts limitations on $CO_2$ emissions, the price of renewables, like biomass, will become far more competitive.

Another key financial variable for biomass-based electricity generation is access and availability of fuel. Biomass fuels, including forest and agricultural residues, are bulky and, as noted earlier, generally have a low energy density. Transportation costs to move the fuel to a generation site can be cost prohibitive. A radius of 50 to 75 miles is critical in terms of accessing supply, according to the Public Renewables Partnership, an organization that focuses on renewable energy partnerships for customer-owned utilities. A haul distance from a forest source of 30-50 air miles (50-80 road miles) can generally keep costs of wood fuel reasonable at a rate of $35-45/ton, according to DNRC estimates.[24] These are rough rule of thumb estimates, and biomass fuel costs are influenced by many factors.

**Another key financial variable for biomass-based electricity generation is access and availability of fuel.**

The former chairman of the Biomass Power Association and a member of the Western Governors' Association Biomass Task force recently investigated the relationship of size to power cost for biomass power facilities using traditional waste wood. He found that the average size of biomass facilities is rising in an attempt to capture economies of scale. However, he finds that larger plants may not yield lower busbar costs. He found that a combination of fuel constraints, capped incentive programs, loss of local options, and availability of combined heat and power options lead to the optimization of facilities at a much smaller size. For example, he notes that in Oregon, a 10-MW cogeneration plant yields a substantially lower busbar cost than a 100-MW stand-alone plant.[25] He also notes that there is a unique biomass solution for every location, and the final question is, "What role does the electric utility play in this development?" He finds that perhaps a positive utility approach to biomass is to offer "biomass only" requests for proposals (RFP's) that match in time a utility's needs for new firm generation or additional renewable power and carbon offsets.

To secure financing for a biomass facility, a power supply agreement is also typically needed. In Montana there are opportunities for agreements with two

[24] http://www.dnrc.mt.gov/forestry/Assistance/Biomass/FAQS.asp

[25] "Biomass Power as a Firm Utility Resource: Bigger not necessarily Better or Cheaper," William H. Carlson, 2009.

utilities, multiple cooperatives, out-of-state purchasers, and large energy customers. In the last 2 years, NorthWestern Energy has received proposals from biomass projects with prices ranging from $95 per MWh to $150 per MWh. (Default supply cost for NorthWestern is about $60 per MWh.) Because of the cost associated with the proposals, and the cheaper alternatives, agreements for biomass generation have not been reached with Montana's largest utility for biomass. NorthWestern Energy in August 2009 issued a competitive Request for Information (RFI) for alternative energy projects to help meet Montana's goals under the Renewable Portfolio Standard. NorthWestern Energy received a total of 39 responses from 30 separate parties. The proposals included two biomass projects for 36 total MW. All the proposals are under review, but NorthWestern Energy's consultant, which conducted the RFI, has identified proposals that should be moved forward to the second phase of analysis. The two biomass proposals are not included in the consultant's recommendations. NorthWestern Energy, however, indicated that developers involved in the two biomass projects are in separate, bilateral discussions with NorthWestern Energy.

**To secure financing for a biomass facility, a power supply agreement is also typically needed.**

In Montana, the PSC is responsible for ensuring that Montana public utilities provide adequate service at reasonable rates. The two regulated electric utilities are NorthWestern Energy and Montana-Dakota Utilities (MDU). Electric cooperatives are not-for-profit entities that are controlled by the members of the cooperative. A board of directors sets customer protection policies and establishes the rates for electricity distribution and supply. In Montana there are 25 electric cooperatives that serve 216, 846 meters.

By law, the PSC must allow utilities to earn a "just and reasonable" profit, so the utility has an incentive to provide adequate service. The PSC, however, does not regulate the wholesale price of electricity. In Montana, NorthWestern Energy purchases electricity from suppliers through contracts to serve Montana customers. The contracts stabilize the price of electricity for their duration. The PSC is charged with ensuring that the contracts NorthWestern Energy enters into are prudent. MDU did not restructure in 1997 when the Legislature approved the Electric Utility Industry Restructuring and Customer Choice Act. This means that all aspects of electricity service provided by MDU to Montana customers remain regulated.

MDU prepares and files an "integrated least-cost resource plan" every 2 years. (Title 69, chapter 3, part 12, MCA). NorthWestern Energy files a portfolio and procurement plan under 69-8-419, MCA, showing how it will provide electricity supply "at the lowest long-term total cost". The PSC then decides on the prudence of a utility's resource procurement practices. The PSC has some flexibility to look at social costs or benefits, but it is limited. NorthWestern Energy, for example, in its resource planning the last 4 years has imputed a cost for carbon dioxide, which has leveled the playing field to some degree for renewables. The PSC historically has shied away from basing its resource decisions on the idea that certain actions would promote economic development or job creation. The PSC focuses on the costs of the resources and tries to eliminate, in economic terms, what might be external costs. The PSC must adhere to Montana law and make sure Montana customers are supplied with the best portfolio mix, which most often means least risk and lowest cost.

## Renewable Portfolio Standard

The Montana Renewable Power Production and Rural Economic Development Act (Title 69, chapter 3, part 20, MCA) requires public utilities operating in Montana to obtain 15% of their retail electricity sales from eligible renewable resources by 2015. The current renewable percentage of NorthWestern's electric supply in Montana is a little bit more than 8%, primarily from wind generation. The current renewable percentage of MDU's electric supply in Montana is 9.5%. Both utilities are meeting the renewable portfolio standard (RPS) largely by integrating wind energy into their systems. At this time low-emission biomass, which is an eligible renewable resource, is not being used by either utility to meet the RPS. Montana's rural electric cooperatives are not required to meet the standard; however, a cooperative with more than 5,000 customers is responsible for recognizing the intent of the standard. Flathead Electric Cooperative is the only cooperative to date working toward the standard. Competitive electricity suppliers also must meet the standard, for example, the city of Great Falls.

**Some states allow the thermal output from a cogeneration system to be included in the standard. Heat is often the most valuable and efficiently derived form of energy from biomass.**

Montana's RPS also includes cost caps that require the alternative energy resource to be cost-competitive with other electricity resources. The cost caps, in many cases, reduce the viability of biomass being used to meet the standard.

As of March 2009, RPS requirements or goals had been established in 33 states, of which 13 states include combined heat and power (CHP or cogeneration) as an eligible resource. Arizona explicitly includes renewable fueled CHP systems. Some states allow the thermal output from a cogeneration system to be included in the standard. To account for the thermal output, the steam output (measured Btu's) is converted to an equivalent electrical output (MWh). "RPS language can be modified to state that CHP output will be calculated as the electric output plus the thermal output in MWh, based on the conversion of 1 MWh = 3.413 MMBtu of heat output."[26] Heat is often the most valuable and efficiently derived form of energy from biomass.

Other states, like Connecticut, are promoting a variety of energy-efficient technologies by developing a system of different technology tiers. A specific percentage of energy production must come from a specified renewable or efficient technology based on the tier. Connecticut and Pennsylvania, for example, can utilize a separate tier for energy efficiency and a separate tier for cogeneration to make sure those resources do not compete against other renewable energy resources. Different generation targets are established for each tier according to state goals, resources, and interests.

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[26] "Energy Portfolio Standards and the Promotion of Combined Heat and Power" Environmental Protection Agency, April 2009.

# Biomass Availability

The U.S. Department of Energy National Renewable Energy Laboratory in 2005 completed a study assessing biomass availability in the country. The report also breaks out biomass resources by state.[27] Overall, the report estimates 4,347 thousand tons/year of biomass available in Montana. In determining crop residues it was assumed that about 35% of the total residue could be collected as biomass.

More specifically for Montana the report finds:

- 1,560 thousand tons/year of crop residues
- 704 thousand tons/year of forest residues
- 21 thousand tons/year of methane from landfills
- 4 thousand tons/year of methane from manure management
- 1,937 thousand tons/year of primary mill biomass
- 13 thousand tons/year of secondary mill biomass
- 106 thousand tons/year of urban wood
- 1 thousand tons/year of methane from domestic wastewater

A number of more detailed studies, specific to Montana, have been completed in more recent years. Those studies are largely focused on woody biomass availability. There is limited information today about agricultural residues; however, volumes of research on the topic are ongoing in Montana.

## Woody Biomass

At the request of the DNRC, a report examining Montana forest biomass availability and supply was completed by the Bureau of Business and Economic Research at the University of Montana. The report was presented to the EQC in January 2010 and is included in **Appendix L**. The assessment examines live trees, standing dead trees, logging residue, and primary mill residue. Live and standing dead tree supply is evaluated on timberland in Montana, including Inventoried Roadless Areas on national forests covering about 6.4 million acres in Montana. The report also reviews sources in the context of ownership. The estimates are also refined looking at the distance between the trees and a road, slopes, and size.

[27] "A Geographic perspective on the current biomass resource availability in the United States," A. Milbrandt, National Renewable Energy Laboratory.

**About 74% of live tree biomass and more than 85% of standing dead tree woody biomass is located on national forest land in Montana.**

In examining live tree biomass, it is noted that small, live trees are abundant. More than 9 billion live trees are on Montana timberland, and about 75% have a diameter less than 7 inches. About 74% of live tree biomass is on national forest land as noted in **Table 5**. The report finds that if live trees are going to be increasingly used for biomass, material from all ownership classes will be necessary. "Other studies have also indicated that national forests in Montana have substantial acreages of timberland that would benefit from restoration and hazardous fuels reduction treatments that involve the removal of woody material that is suitable for both biomass and traditional wood products utilization."[28] If the numbers for live trees are refined, about 20% of the live tree biomass on Montana timberland is within 1,000 feet of a road, and about 40% is more than 1 mile from a road. About 65% is on land with a slope of less than 40%. These figures indicate the amount of biomass that is more or less accessible using a ground-based harvesting system.

**Table 5: Live Tree Biomass**

| Live tree woody biomass and timberland acreage by ownership | | | |
|---|---|---|---|
| **Ownership class** | **Dry tons** | **% of biomass** | **Tons per acre** |
| National Forest | 538,449,891 | 74.28% | 44.08 |
| Private | 130,075,160 | 17.94% | 21.29 |
| State | 29,287,009 | 4.04% | 37.29 |
| BLM | 27,054,323 | 3.73% | 30.02 |
| County and City | 66,388 | 0.01% | 4.86 |
| **Total** | **724,932,771** | **100%** | **36.20** |

*Source: Todd Morgan, Forest Industry Research, Bureau of Business and Economic Research, UM*

Standing dead trees are also prevalent in Montana. The assessment does not include biomass that is on the ground, like fallen trees, needles, or limbs. Ownership is again a critical issue, with more than 85% of standing dead tree woody biomass located on national forests in Montana as noted in **Table 6**.

[28] "An Assessment of Forest-based Woody Biomass Supply and Use in Montana," Todd Morgan, Bureau of Business and Economic Research, University of Montana, page 6.

**Table 6: Standing Dead Tree Biomass**

| Standing dead tree woody biomass and timberland acreage by ownership | | | |
|---|---|---|---|
| **Ownership class** | **Dry tons** | **% of biomass** | **Tons per acre** |
| National Forest | 115,715,924 | 85.2% | 9.47 |
| Private | 12,776,792 | 9.4% | 2.09 |
| State | 4,409,443 | 3.2% | 5.61 |
| BLM | 2,892,950 | 2.1% | 3.21 |
| **Total** | **135,795,109** | **100%** | **6.78** |

*Source: Todd Morgan, Forest Industry Research, Bureau of Business and Economic Research, UM*

The refined numbers included in the assessment provide an even clearer picture of biomass availability in Montana. Using filters, like proximity to roads and slope, the report provides a more conservative estimate of live and standing dead trees for biomass. The filtered estimate shows about 93.1 million dry tons of live and dead standing trees on about 3.59 million acres of timberland that is a half-mile or less from a road on land with slopes no more than 40% and in forests less than 100 years old. The 3.59 million acres, however, accounts for less than one-third of the 13.6 million acres not in Inventoried Roadless Areas. "From this example, one can see that a relatively small portion (18%) of timberland in Montana could provide a substantial amount of woody biomass for existing and new facilities."[29] Once again, national forest land plays a critical role. As noted in **Table 7**, nearly 70% of the potentially available live and standing dead tree woody biomass, available with the filters, is on national forest land. "Assuming that the data filters used in this paper provide reasonable approximations of the social constraints impacting availability of woody biomass from live and standing dead trees on Montana timberlands, the 40.3 million dry tons of potentially available smaller-tree woody biomass represents just 5% of the current total live and standing dead tree woody biomass across all Montana timberlands."

[29] "An Assessment of Forest-based Woody Biomass Supply and Use in Montana," Todd Morgan, Bureau of Business and Economic Research, University of Montana, page 9.

**Table 7: Live and Dead Tree Woody Biomass**

| Live and standing dead tree woody biomass and acreage by ownership (.5 miles or less from a road, slope 0-40%, stand ages 0-100 years, tree db h 5-10.9 in.) | | | |
|---|---|---|---|
| **Ownership class** | **Dry tons** | **% of biomass** | **Tons per acre** |
| National Forest | 28,066,368 | 69.7% | 17 |
| Private | 10,577,416 | 26.3% | 6.06 |
| State | 1,040,096 | 2.6% | 10.44 |
| BLM | 609,974 | 1.5% | 6.91 |
| **Total** | **40,293,854** | **100%** | **11.24** |

*Source: Todd Morgan, Forest Industry Research, Bureau of Business and Economic Research, UM*

The report also examines logging residue, or material that is left in the forest during the harvesting of timber—often called "slash". The majority of logging residues in Montana are on private timberlands because that is where the majority of timber is harvested in Montana. Three Montana counties also account for one-half of the timber harvest in Montana: Flathead, Lincoln, and Missoula. It also must be noted that timber harvesting has declined. In 2007 the harvest was about 70% of the 2004 harvest level, and the 2008 level was about 60% of the 2004 level. The total amount of logging residue produced during the harvesting of timber products in Montana in 2004 was estimated to be about 860,641 dry tons. The report finds that logging residue could meet some of the demand, but it too has dropped, from 0.86 million dry tons per year in 2004 to 0.52 million dry tons per year in 2008. Logging residue isn't as desirable as mill residue because the former often contains contaminants, like rocks, sand, or dirt.

Mill residue, the preferred form of woody biomass for most users, is a byproduct from the manufacturing of primary wood products, so it tracks closely to in-state lumber production. The generation of mill residue continues to decrease because of improved milling technology, declining timber harvest volumes, and a reduction in milling capacity. The vast majority, between 99% and 100% of mill residue, is also utilized by the pulp and reconstituted board industry, burned as fuel, or used for other purposes. Mill residue production in Montana in 2004 was about 1.5 million dry tons, indicating a sizeable deficit between the amount available and consumed. (Woody biomass users consume between 2.2 and 2.7 million dry tons of biomass, mostly mill residue, in a year.) "That deficit was filled in part by mill residue from out-of-state mills as well as by the use of some slash, industrial fuelwood, and roundwood pulpwood harvested in Montana."[30] Volumes of mill residue produced in Montana have also declined since 2004 because of reduced timber harvest and mill shutdowns related to market conditions.

While the supply of logging and mill residue continues to decline in Montana, the supply of live and standing dead tree woody biomass continues to increase. "A substantial supply of live and standing dead trees that could be used for biomass energy or biofuels, as well as traditional wood products exists on timberland in the state."[31] The report puts the availability estimates into perspective, noting that the timber harvest in Montana declined by 68% over the last 20 years, including a 60% decline in private land harvesting and an 88% decline in harvesting on national forest land. An increase in harvesting, salvage logging, fire-hazard reduction treatments, and other activities "would help to slow or reverse the current trends and would require significant changes in the social and economic factors influencing forest management in the state."[32]

The U.S. Forest Service and BLM started a series of "CROP" pilot projects to address the growing fuel load in major forest systems and the potential for catastrophic wildfires. The CROP studies are focused on actual planned projects and estimated volumes of biomass to be available from those projects, rather than on the total volume of biomass that is present, growing, and dying on various lands. The CROP model was developed in 2003 by Oregon-based Mater Engineering.

**While the supply of logging and mill residue continues to decline in Montana, the supply of live and standing dead tree woody biomass continues to increase.**

For each CROP report, a detailed resource offering map is provided that shows biomass removal data for every species to be removed from an area during the next 5-year period. It is broken down by volume, diameter sizes, species, harvest type (fuel load reduction, timber sale, etc.), location of offering, NEPA phase for each offering, and road accessibility. The maps provide a picture of who will be offering supply, when it will be offered, how much will be offered, diameter size to be offered, and whether the supply will be consistent and level over time.

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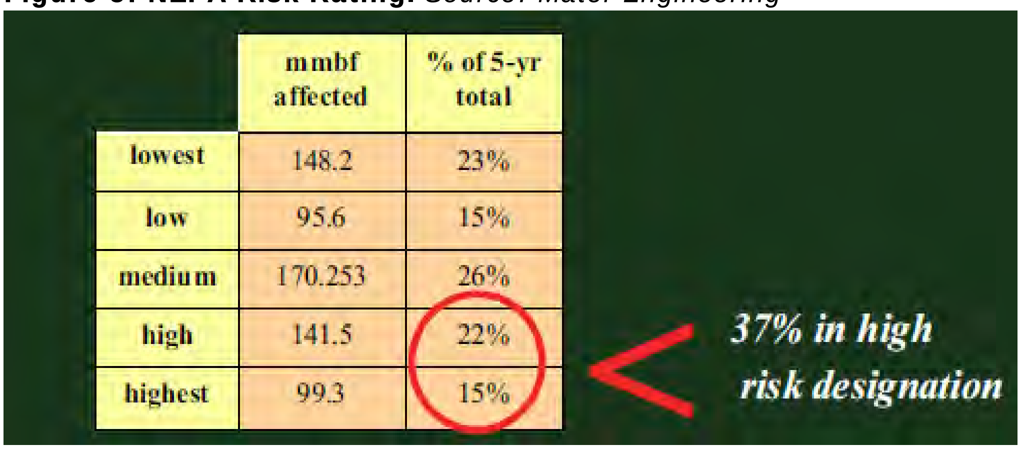
[30] "An Assessment of Forest-based Woody Biomass Supply and Use in Montana," Todd Morgan, Bureau of Business and Economic Research, University of Montana, page 18.

[31] Ibid, page 20.

[32] Ibid, page 21.

The western Montana report was released in September 2009. It covered six national forests, state land, and three BLM districts. The report covers 15 Montana counties. Information about live and dead stands is also included. The volume estimates were based on data from the 2008 timber sale program extrapolated forward to apply to planned project areas. The data does not include biomass components that may not have been delimbed and decked, non-sawlog material that was onsite, slash at log landings, mechanical fuels reduction projects without required removal, precommercial thinning volume, forest health treatment volume, or firewood removal. The Forest Service is working to address the elements that are not currently included in the CROP database.

**Figure 5: NEPA Risk Rating.** *Source: Mater Engineering*



| | mmbf affected | % of 5-yr total |
|---|---|---|
| lowest | 148.2 | 23% |
| low | 95.6 | 15% |
| medium | 170.253 | 26% |
| high | 141.5 | 22% |
| highest | 99.3 | 15% |



The NEPA review shows that more than half of the identified biomass resource offering is either NEPA approved or in-process. However none of the 11 to 13 inch diameter has been approved, and significant volume, about 263 million board feet, has not yet started the process. A NEPA risk rating is also shown in **Figure 5.**

## Agricultural Residues

A high-level, statewide assessment of biomass availability for Montana has been developed by the U.S. Department of Energy, Energy Efficiency and Renewable Energy Office (EERE). The report finds there are 4.3 million dry tons of cellulosic biomass available in the state, along with 0.1 million dry tons of total crop biomass. The greatest potential for use of crop residue is largely centered around northern Montana, with Pondera, Hill, Chouteau, and Blaine counties having some of the greatest potential, according to the EERE maps. The report also offers a "potential production" scenario for 2009, predicting that 301 million gallons of ethanol with cellulosic biomass as feedstock could be produced in Montana. The DEQ provided the EQC with an overview of agricultural biomass availability, which is in **Appendix M**.

Researchers at Montana State University's College of Agriculture and the Montana Agricultural Experiment Station are conducting research looking at how to advance biobased products in Montana. "Montana farms produce 10 million tons of wheat and barley straw that are typically left in the field. An additional five million tons of hay are produced annually,"said Dave Wichman, superintendent of the Central Agricultural Research Center. "The advantage of using annual farm crops for ethanol production is that farmers can produce biomass with conventional crops and equipment, and can alternate crop production for energy, food, or feed."[33]

Researchers at the Ag Research Center in Moccasin are studying how to maximize the volume of Montana crops or residues with less input. Research is also underway to find the most efficient enzyme to break down the biomass into sugars and ferment the sugars into fuel. Researchers in the College of Agriculture and College of Engineering are also looking at using agricultural crop residue as an alternative to wood for pellet fuels used in residential stoves and commercial boilers. Researchers are looking at the availability of agricultural residues from each section of Montana to show fuel pellet manufacturers where they can find residues. The review also includes an examination of the highest estimated energy content in the residues.

The Western Governors' Association (WGA) has conducted several detailed biomass resource assessment studies, largely aimed at biomass for transportation fuel purposes. In September 2008 the WGA published a "Strategic Assessment of Bionenergy Development in the West: Biomass Resource Assessment and Supply Analysis for the WGA Region". The report, developed by Kansas State University and the U.S. Forest Service, includes information on agricultural crop residues. A look at the supply of various agricultural crop residues at different price levels in Montana is included in **Table 8.**

**Table 8: Agricultural Residues**

| **Supply of Agricultural Residues at Different Price Levels in Montana** | | | | | |
|---|---|---|---|---|---|
| **Crop** | **$30** | **$35** | **$40** | **$45** | **$50** |
| Winter Wheat | 0 | 2,692 | 13,182 | 95,342 | 105,148 |
| Spring Wheat | 0 | 0 | 7,468 | 8,381 | 8,460 |
| Barley | 0 | 0 | 14,676 | 37,520 | 50,198 |
| Oats | 0 | 0 | 329 | 1,385 | 1,945 |

*Source: WGA, Strategic Assessment of Bioenergy Development in the West*

[33] http://www.montana.edu/cpa/news/nwview.php?article=3899

The WGA also has teamed up with the University of California-Davis to complete a detailed study of the supply of biofuel over a range of fuel prices.[34] In **Figure 6**, the supply curve shows the cost of producing the most expensive gallon of biofuel of the total quantity at the given price. The second example, **Figure 7**, shows the consumption of Montana's biomass resources for biofuel production.

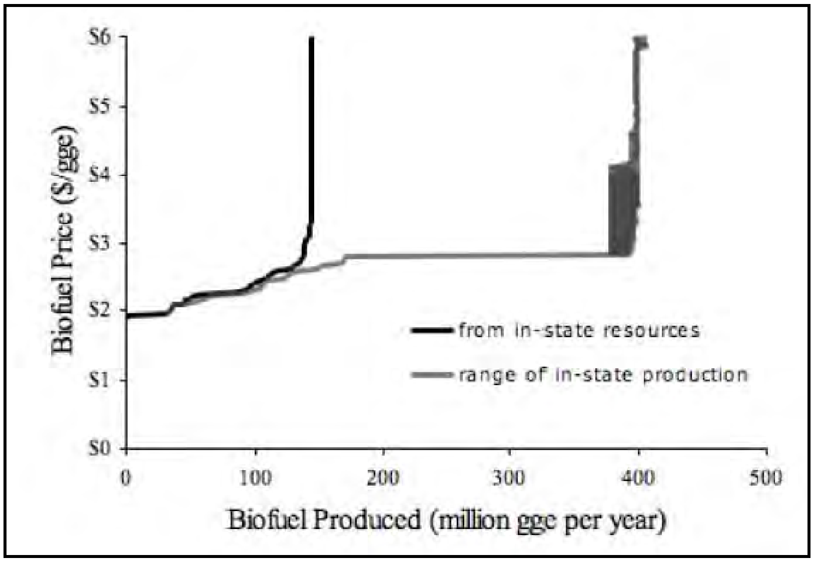



**Figure 6: Agricultural Biofuel Production Costs.**
*Source: Western Governors' Association*

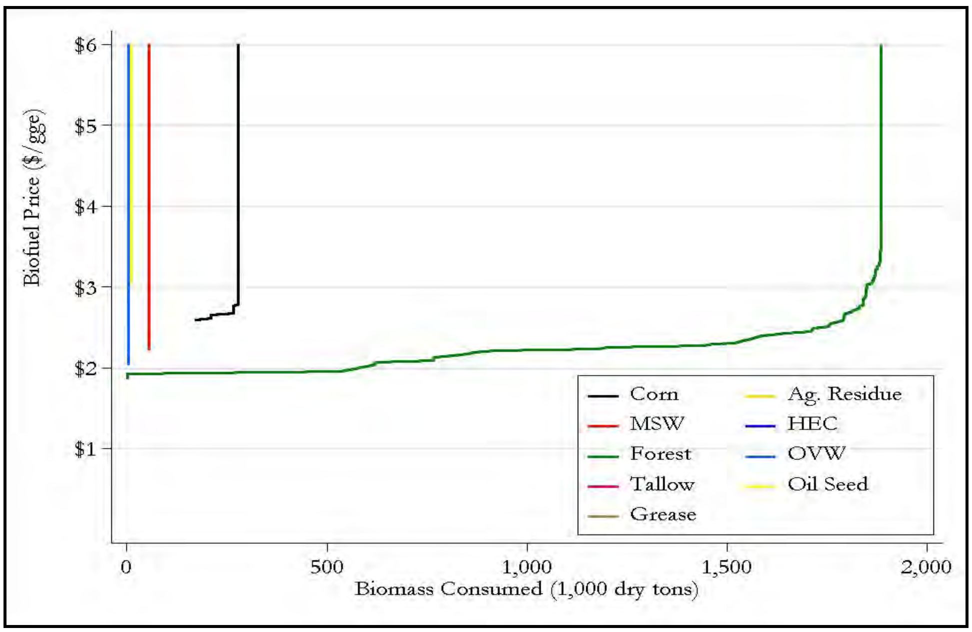



**Figure 7: Agricultural Biomass Consumption.**
*Source: Western Governors' Association*

Agricultural crop residues contemplated in the WGA report include corn stover and small-grain straws, including wheat, barley, and oats. Mixed grass species crops and orchard and vineyard trimmings are also included. The report concludes that the amount of field crop residue

[34] http://www.westgov.org/wga/initiatives/transfuels/Task%203.pdf, Appendix B.

available for bioenergy use in the region covered by the WGA, particularly from barley, oats, and rye, is small for three reasons:

1. Production is limited because of climate and markets, reducing any significant quantity of residue.

2. Supply is based on a wind erosion equation, which was not specifically designed to analyze residue removal in the west.

3. Residue removal is largely based on field management (tillage) practices.[35]

[35] "Strategic Assessment of Bioenergy Development in the West", Western Governors' Association, Kansas State University and the U.S. Forest Service, September 2008.

# Biomass Technologies

A variety of technologies for converting biomass feedstocks to electricity and heat are commercially available in the United States. **Tables 9 and 12** provide a brief overview of two of the most common large-scale processes: direct combustion and gasification. Biomass can be used in its solid form or gasified for heating applications or electricity generation, or it can be converted into liquid or gaseous fuels. Biomass conversion refers to the process of converting biomass feedstocks into energy that is used to generate electricity, heat, or both.

**Biomass can be used in its solid form or gasified for heating applications or electricity generation, or it can be converted into liquid or gaseous fuels.**

When considering the various technologies required to produce biomass feedstocks and convert them into useful biofuels and electricity, feedstocks, processing and conversion technologies, and infrastructure are considered. Biomass combustion facilities can burn different feedstocks, like wood, pulping liquor, and agricultural residues. The information provided below focuses on combustion technologies that convert biomass fuels and forestry and agricultural residues into energy for commercial or industrial use. Those uses include hot water, steam, and electricity. Availability of materials, cost, local energy needs, existing infrastructure, and access to conversion technologies are issues a project developer considers in selecting a project.

## Wood Stoves

About 7.5% or 27,034 Montana households rely on wood for heat, according to the 2000 U.S. Census.[36] A survey of residential energy consumption by the Energy Information Administration in 2005 showed that 14.4 million U.S. households use wood to heat their homes. A consideration, however, is that many wood stoves are old and do not meet federal emission standards. During a typical wood heating season, wood smoke can account for as much as 80% of the particulate matter (PM) emissions in a residential area, depending on usage patterns.[37] This illustrates

[36] http://factfinder.census.gov/servlet/QTTable?_bm=y&-geo_id=04000US30&-qr_name=DEC_2000_SF3_U_DP4&-ds_name=DEC_2000_SF3_U&-redoLog=false

[37] http://www.epa.gov/woodstoves/programs.html

a problem that has received attention in Montana, particularly related to the advancement of biomass.

Montana is among 25 states nationwide that have areas being formally proposed as nonattainment for failing to meet PM 2.5 standards, according to the EPA. Based on the most recent monitoring data, Libby is the only area in Montana that does not meet the standard. The EPA is working with Lincoln County, the DEQ, and the Hearth, Patio & Barbecue Association to bring the community into compliance. By January 2007, 1,110 older wood stoves had been replaced with EPA-certified stoves that produce only 2 to 5 grams of smoke per hour, compared to 15 to 30 grams from older stoves. To facilitate the change about $1 million was donated by industry, $100,000 from the EPA, and $50,000 from the state. More recent data has shown that fine particulate levels in the outdoor air have decreased by about 30%.[38] Other areas in western Montana, such as Missoula, have bordered on nonattainment or failed to meet standards. Wood stove change out programs have been proven to be a useful tool in promoting the use of biomass while meeting air quality standards. "Use of fire wood in EPA-approved wood stoves is a cost-competitive and mature technology that provides a clean renewable energy alternative to heating oil or coal."[39]

**Wood stove change out programs have been proven to be a useful tool in promoting the use of biomass while meeting air quality standards.**

Wood pellets also are increasingly popular. The pellets are the compressed byproducts from the forestry industry, like woodchips and sawdust, or other material, such as camelina residue. The DOE notes that pellet stoves are the cleanest of solid fuel-burning residential heating appliances. "With combustion efficiencies of 78%–85%, they are also exempt from EPA smoke-emission testing requirements."

## Direct Combustion

Biomass boilers can be used for heat and used for steam and power. Using direct combustion to create hot gases that produce steam in a boiler is the most common utilization of biomass for heating and electricity generation. Combined heat and power, better known as cogeneration, is the combined generation of steam and

[38] "Clearing the Smoke: The Wood Stove Changeout in Libby, Montana", Hearth, Patio and Barbecue Association, January 2008.

[39] "Wood to Energy in Washington: Imperatives, Opportunities, and Obstacles to Progress", The College of Forest Resources University of Washington Report to the Washington State Legislature, June 2009, page 7.

electricity. "Biomass fuels are typically used most efficiently and beneficially when generating both power and heat through CHP." Smurfit-Stone used a combined heat and power system. Fuels for Schools projects in Montana use boilers for heating purposes.

A typical boiler and steam turbine can create 100 MMBtu per hour, providing about 10 MW of electricity.[40] Underfeed, overfeed, or spreader stokers provide fuel and combustion air. Underfeed stokers are better suited to dry fuel and their use has diminished due to cost and environmental concerns. Spreader stokers are versatile and commonly used. Fluidized bed boilers are a more recent development and produce fewer sulfur dioxide and nitrogen oxide emissions. They are more capable of burning lower quality feedstocks, unlike more conventional methods.

Biomass cofiring is another combustion process. It is the process of combining biomass material with coal in existing coal-fired boilers. Cofiring is used by about 182 organizations in the United States, with about 63% used at industrial operations, according to the Federal Energy Management Program.

In Montana, Thompson River Co-Gen opened in December 2004 and burned coal and waste wood to produce the electricity. The plant only operated about 9 months before being charged with exceeding the nitrogen oxide and sulfur dioxide emission limits allowed by its initial air quality permit. Prior to closing, Thompson River Co-Gen had an agreement to send its power to Thompson River Lumber Co. and to NorthWestern Energy. A new air quality permit for the facility was issued by DEQ but was challenged. In January 2010 the case was sent back to the District Court and the Board of Environmental Review.

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[40] "Biomass Combined Heat and Power Catalog of Technologies", U.S. Environmental Protection Agency Combined Heat and Power Partnership, September 2007, page 31.

**Table 9: Direct Combustion Boiler Technology**

| Direct Combustion -- Boilers | |
|---|---|
| Energy Conversion Technology | Conversion Technology Commercialization Status |
| Fixed bed boilers | Commercial technology -- Stoker boilers are standard technology for biomass as well as coal, and are offered by multiple manufacturers. |
| Fluidized bed boilers | Commercial technology -- Fluidized bed boilers are a newer technology, but are increasingly being used in the U.S. Many manufacturers are European-based. |
| Cofiring | Commercial technology -- Cofiring biomass with coal has been successful in a variety of boiler types. |
| Modular direct combustion | Commercial technology -- Small boiler systems commercially available for space heating. There are demonstration projects in the combined heat and power configuration. |

*Source: EPA Combined Heat and Power Partnership*

The EPA has developed a comparison of combustion characteristics and fuel issues for stoker and fluidized bed boilers. Stoker boilers are a standard technology, and fluidized bed boilers are newer and more complex. The fluidized bed systems provide operating flexibility because they can operate under a variety of load conditions. The EPA provides total capital cost estimates (equipment and installation) for stoker and fluidized bed systems based on three biomass fuel feed rates as shown in **Table 10.** The feed rates are comparable to steam systems producing 20,000; 150,000 to 185,000; and 250,000 to 275,000 lb/hr of steam.[41]

**Table 10: Boiler Costs**

| Total Installed Cost (based on biomass fuel feed) | | | |
|---|---|---|---|
| **Technology** | **100 tons/day** | **600 tons/day** | **900 tons/day** |
| **Stoker Boiler** | $4.6 million | $23.4 million | $30.4 million |
| **Fluidized Bed** | $9.6 million | $29.9 million | $39.4 million |

*Source: EPA Combined Heat and Power Partnership*

## Gasification

Biomass gasification is the process of heating biomass in an oxygen-starved environment to produce syngas. There are different types of biomass gasification processes and there are also different types of commercial gasification systems,

[41] "Biomass Combined Heat and Power Catalog of Technologies", U.S. Environmental Protection Agency Combined Heat and Power Partnership, September 2007, page 38.

including updraft, downdraft, and fluidized bed. All of these systems and processes involve different chemical reactions to generate energy. "Compared with direct-fired biomass systems, gasification is not yet an established commercial technology. There is great interest, however, in the development and demonstration of biomass gasification."[42]

Gasification is receiving more attention because it creates a gaseous fuel that is versatile and can be used in boilers and engines or blended with other fuels. It also can reduce emissions, compared to direct-fired systems. Gasification processes also allow a wide range of feedstocks to be used in the basic process, including both woody and agricultural residues. Similar to direct combustion, fixed bed and fluidized bed gasifiers can be used.

There are very few commercially-operated biomass gasification systems operating in the United States, with most operating as government-funded demonstration projects. The McNeil Generating Station demonstration project in Burlington, Vermont, provides an example of a biomass gasification plant. It generated 50 MW of electricity for Burlington residents. The facility was a wood combustion facility that used waste wood from area forestry operations. At full load, about 76 tons of wood chips were consumed per hour. It also operated with natural gas, using 550,000 cubic feet of gas per hour at full load.

**Table 11: Gasification Costs**

| Biomass Gasification Capital Costs to Produce Syngas | | | | |
|---|---|---|---|---|
| **Gasifier** | **Fixed** | **Fluidized** | **Fluidized** | **Fluidized/high-pressure** |
| **Tons/day** | 100 | 260 | 450 | 1200 |
| **Installed Capital Cost** | $4.5 million | $19 million | $27.7 million | $61.7 million |

*Source: EPA Combined Heat and Power Partnership*

A low-pressure wood gasifier was added in 1999 to convert 200 tons per day of wood chips into fuel gas. That gas was then fed into the existing boiler to augment the plant's production by up to 12 MW.[43] After DOE testing and funding ended in

[42] "Biomass Combined Heat and Power Catalog of Technologies", U.S. Environmental Protection Agency Combined Heat and Power Partnership, September 2007, page 46.

[43] https://www.burlingtonelectric.com/beta/page.php?pid=75&name=mcneil

2002, the gasifier was decommissioned.[44] The EPA has developed a comparison of some of the total installed capital costs of biomass gasification to produce syngas. The main cost for gasification is the gasification reactor. The next major cost is tied to the gas cleanup technologies. Capital costs for the gasification section and for a biomass-to-syngas plant are shown in **Table 11**.[45]

**Table 12: Gasification Technology**

| Gasification | |
|---|---|
| Energy Conversion Technology | Conversion Technology Commercialization Status |
| Fixed bed gasifiers<br><br>Fluidized bed gasifiers | Emerging technology -- There are estimated to be less than 25 biomass gasification system in operation worldwide.<br>There are an estimated 50 manufacturers offering commercial gasification plants in Europe, the U.S., and Canada. About 75% offer fixed-bed and 20% offer designs for fluidized-bed. |
| Modular gasification technology | Emerging technology -- Demonstration projects with research, design, and development funding are moving forward. |
| Modular hybrid gasification/combustion | Emerging technology -- Limited commercial demonstration |

*Source: EPA Combined Heat and Power Partnership*

## Pyrolysis

Pyrolysis and gasification are related processes, heating biochar with limited oxygen. Pyrolysis, however, is generally a process that includes virtually no oxygen.[46] Ensyn Technologies recently became partners with a Honeywell Company to develop technology and equipment to convert biomass into pyrolysis oil for heat and power.

Biochar can be created by traditional gasifiers and by pyrolysis. Pyrolysis is the most recognized process in this arena. Units are operated, as noted above in the gasification description, to produce syngas that can be used for heat, power, or both. With biochar, the carbon in the feedstock is captured in the biochar. Biochar is

[44] http://rentechinc.com/silvaGas.php

[45] "Biomass Combined Heat and Power Catalog of Technologies", U.S. Environmental Protection Agency Combined Heat and Power Partnership, September 2007, page 53.

[46] http://www1.eere.energy.gov/biomass/printable_versions/pyrolysis.html

a porous charcoal-like substance that stores carbon and can improve soil fertility and stimulate plant growth. The biochar then captures about 50% of the original carbon in the biomass and stores it in soil, according to the International Biochar Initiative.[47] The organization is advocating biochar as a strategy to reduce greenhouse gas emissions and to sequester carbon.

The USDA Forest Service and Agriculture Research Service are both involved in biochar research projects. Researchers at the Forest Service Rocky Mountain Research Station, the University of Montana, and the University of Idaho are interested in deploying a commercial-scale bio-oil and/or biochar production system as part of an ongoing research project in the Umpqua National Forest region of Oregon[48] In August 2009, the first major biochar conference was held in the United States. The Center for Energy and Environmental Security at the University of Colorado in Boulder was the lead sponsor and organizer. The goal of the conference was to promote policies, technologies, business, and scientific opportunities to advance the large-scale use of biochar.

Biochar also is gaining interest in the agricultural sector. Biochar has been shown to "increase soil fertility, improve water retention, lower soil acidity and density, and increase microbial activity."[49] An example of how biochar would be used is that a farmer could take crop residue to a pyrolysis facility where it would be heated and starved of oxygen. The end result would be biochar that the farmer could take back to the farm and spread on a field for fertilizer. At the same time, the gas from the pyrolysis process could be captured and used to generate electricity or to produce heat.

During the EQC's July 2010 meeting, members learned more about Algae Aqua-Culture Technologies and biochar research and application in Montana. Algae Aqua-Culture Technologies integrates low-temperature geothermal and solar energy sources to grow algae in a setting that creates methane fuel, organic fertilizer, and other soil amendments. Presentations by John Murdock of Algae Aqua-Culture Technologies and Gloria Flora, a biochar expert, are included in **Appendix N**.

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[47] http://www.biochar-international.org/images/White_Paper.doc

[48] http://www.biocharproducts.com/index.php?option=com_content&view=article&id=127&Itemid=129

[49] *The Prairie Star*, "Biochar increases soil fertility, improves soil water retention," Terri Adams, May 7, 2010.

## Cellulosic Ethanol

Forest and agricultural residues, as well as municipal and solid waste, can be used as feedstock for transportation fuels. To make cellulosic ethanol the woody plant cells of the biomass must be broken down. There are typically three methods for doing this: using special enzymes, acids, or heat and pressure. AE Biofuels in Butte is utilizing a form of this technology.

There is a growing interest in cellulosic ethanol, which is an alternative to corn-based ethanol. An estimated $682 million has been spent by venture-capital firms since 2006, a sizeable increase compared to the $20 million spent in the previous 2 years. The DOE also has provided about $850 million for research and development.[50] Verenium's 1.4 million gallon per year cellulosic ethanol plant in Jennings, Louisiana, is considered the first demonstration-scale plant capable of producing ethanol from biomass sources. It started operating in early 2009.

Nearly a dozen cellulosic demonstration plants and six larger commercial facilities intend to begin operations by 2012, according to the Renewable Fuels Association. However, the costs associated with cellulosic ethanol continue to be an issue worthy of consideration. "A detailed study by the National Renewable Energy Laboratory in 2002 estimated total capital costs for a cellulosic ethanol plant with a capacity of 69.3 million gallons per year at $200 million. The study concluded that the costs (including capital and operating costs) remained too high in 2002 for a company to begin construction of a first-of-its-kind plant without significant short-term advantages, such as low costs for feedstocks, waste treatment, or energy." [51]

## Advancements in Biomass Equipment Technologies

During the EQC's May 2010 meeting, EQC members and the public were invited to view a biomass equipment demonstration. Steve Marks of Marks Lumber in Clancy demonstrated the operation of a Rotochopper B-66. The chopper maximizes efficiency in processing raw wood fiber and agricultural residues. The advanced equipment can provide higher production rates than a typical grinder. The chopper also provides consistent uniformity of material, which is attractive to biomass developers. In addition, the chips can be densely packed into trailers and allow more tons per trailer than a traditional grinder, saving on transportation costs to biomass facilities.

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[50] *USA Today*, "Start-ups put farm debris to use as fuel," January 9, 2009.

[51] http://www.eia.doe.gov/oiaf/analysispaper/biomass.html

Representatives of John Deere provided a demonstration of their advanced harvesting systems. A John Deere 1490D Energy Wood Harvester was brought from Kelso, Washington, and shown to the EQC. The equipment produces biomass by clearing the forest floor of slash. The Energy Wood Harvester, also called a bundler, can pick up the tops of trees and branches left over from harvesting and put them into the feeder. The equipment tightly compresses, wraps, and cuts a slash log usually about 10 feet long and 24 to 32 inches in diameter. The logs, or bundles, can then be transported and used as biomass fuel. Each log provides about 1 MWh of energy, according to John Deere.

Pictures of the demonstration are included in **Figures 8 and 9**.

**Figure 8**: John Deere Harvester, *DEQ photo*

**Figure 9:** Rotochopper, *DEQ photo*

Like other energy combustion sources, wood boilers emit pollutants, including particulate matter (PM), nitrogen oxides (NOx), carbon monoxide (CO), volatile organic compounds (VOC), sulfur dioxide (SO2), and carbon dioxide (CO2)[52], which are regulated by both state and federal entities. As previously reported, particulate matter is of particular concern in Montana, where wood stove and commercial/industrial emissions already exceed air quality levels at certain times of the year and in certain weather conditions. Volatile organic compounds, meanwhile, are known contributors to smog and ozone-related air quality problems.

## Emissions in Montana

Due to a lack of empirical data, the Fuels for Schools program has sponsored stack emissions testing on a variety of biomass systems in Montana, Idaho, and North Dakota to better characterize and understand the nature of air emissions from small-scale wood-fired boiler systems.[53] As part of that effort, testing of wood boilers in Darby, Victor, Dillon, Townsend, and Bismarck, North Dakota, was conducted between October 2007 and March 2008. The type of combustion system, facility served, and fuel source are detailed in **Table 13** below.

**Table 13, Biomass Emissions and Combustion Systems**
*Source: http://www.fuelsforschools.info/pdf/MemoSummary.pdf*

| **Location** | Bismarck, ND | Darby, MT | Victor, MT | Dillon, MT | Townsend, MT |
|---|---|---|---|---|---|
| **Combustion Chamber Type** | Stoker | Stoker | Stoker | Close-coupled gasifier | Stoker |
| **Heat Input (MMBtu/hr)** | 1.0 | 3.3 | 2.6 | 19.0 | 0.75 |
| **Facility Served by Boiler** | Landfill Buildings | Secondary School Buildings | Secondary School Buildings | University Campus | Secondary School Buildings |
| **Fuel Type** | Municipal Vegetation and Pallets | Bole Tree Chips | Bole Tree Chips | Bark | Wood Pellets |
| **Fuel Used during Stack Test** | Variable | Lodgepole Pine | Lodgepole Pine | Douglas Fir Bark | Sawdust |
| **Pollution Control Present?** | No | No | No | Yes - multicyclone | No |

[52] http://fuelsforschools.info/tech_info.html#Air%20Quality

[53] http://www.fuelsforschools.info/air_emission_test_reports.html

Each stack test measured the type and size of particulate matter emitted, as well as nitrogen dioxide and carbon monoxide emissions. The subsequent analysis took into consideration any state and EPA emission standards and boiler combustion efficiency.

Test results showed that the source of fuel can have a significant effect on emission rates and heat content, as shown in **Table 14**. A written summary of the test results concluded that Bismarck may have had the highest heat content due to the relatively low moisture content of the pallets it used for fuel. The summary also stated that Bismarck's high ash content was likely due to the fact that dirt attached to roots and stumps wasn't separated from the vegetative fuel source Bismarck also uses. Of the Montana sites, Dillon had the highest ash content, likely because Dillon burned bark.

**Table 14: Biomass Emissions and Fuel Sources**
*Source: http://www.fuelsforschools.info/pdf/MemoSummary.pdf*

| Fuel Parameter | Bismarck | Darby | Victor | Dillon | Townsend |
|---|---|---|---|---|---|
| Heat Content (HHV in btu/lb)) | 10,997 | 4,675 | 4,675 | 5,985 | 8,161 |
| Ash Content (%) | 30.11 | 0.03 | 0.03 | 1.5 | 0.52 |
| Fuel Moisture Content (%) | 5.0 | 46.3 | 46.3 | 33.1 | 5.1 |
| Nitrogen Content (%) | 0.04 | 0.33 | 0.33 | 0.1 | 0.07 |

As for particulate matter (PM), the tests found that the type of fuel again likely contributed to significant differences in the emissions results. As shown in **Table 15**, Bismarck emitted approximately two to three times more condensable PM than the other boilers, while Townsend emitted the most particulate matter greater than 2.5 microns (56%) in size (PM 2.5) and the least amount of filterable PM 2.5 (33%).

**Table 15: Summary of Particulate Composition Data**
*Source: http://www.fuelsforschools.info/pdf/MemoSummary.pdf*

| Size Fraction | Operating Capacity | Bismarck | Darby | Victor | Dillon | Townsend |
|---|---|---|---|---|---|---|
| PM>2.5 | Low Fire | 17% | 48% | 30% | 8% | 56% |
| | High Fire | 33% | 36% | 48% | 22% | 56% |
| | Average | 25% | 42% | 39% | 15% | 56% |
| Filterable PM 2.5 | Low Fire | 46% | 45% | 61% | 79% | 31% |
| | High Fire | 26% | 54% | 49% | 75% | 34% |
| | Average | 36% | 50% | 55% | 77% | 33% |
| Condensable PM | Low Fire | 36% | 8% | 9% | 9% | 13% |
| | High Fire | 42% | 7% | 3% | 3% | 10% |
| | Average | 39% | 8% | 6% | 6% | 12% |

When it came to nitrogen oxides (NOx), Bismarck emitted approximately twice as much as the other facilities. In Montana, the Dillon facility emitted the most. As for carbon monoxide, Townsend emitted six to ten times more than all of the others, possibly due to a relatively higher airflow through the pellet boiler system.[54]

Besides fuel source, combustion efficiency also appears to play a large role in a facility's rate of emissions. As part of the stack tests, the average combustion efficiency of all of the involved facilities was calculated and found to be either 99.8% or 99.9%, with the exception of Townsend which was calculated at 99.1%. This may partly explain the higher CO and total particulate matter emissions at the Townsend site.[55]

With the exception of Townsend's CO level, all of the facilities' emissions fell under the applicable federal and state thresholds.[56] However, Dillon's facility is the only one large enough to actually require an air pollution control permit.

One final note on the character of emissions from a direct-fired biomass or dedicated biomass IGCC facility is that both can produce far less carbon monoxide, particulate matter, sulfur dioxide, and nitrogen oxide than an average coal fired facility or a coal/biomass cofiring facility.[57] **Figure 10** shows these emissions. Meanwhile, direct-fired and dedicated biomass facilities produce emission levels similar to that of a natural gas combined cycle facility.

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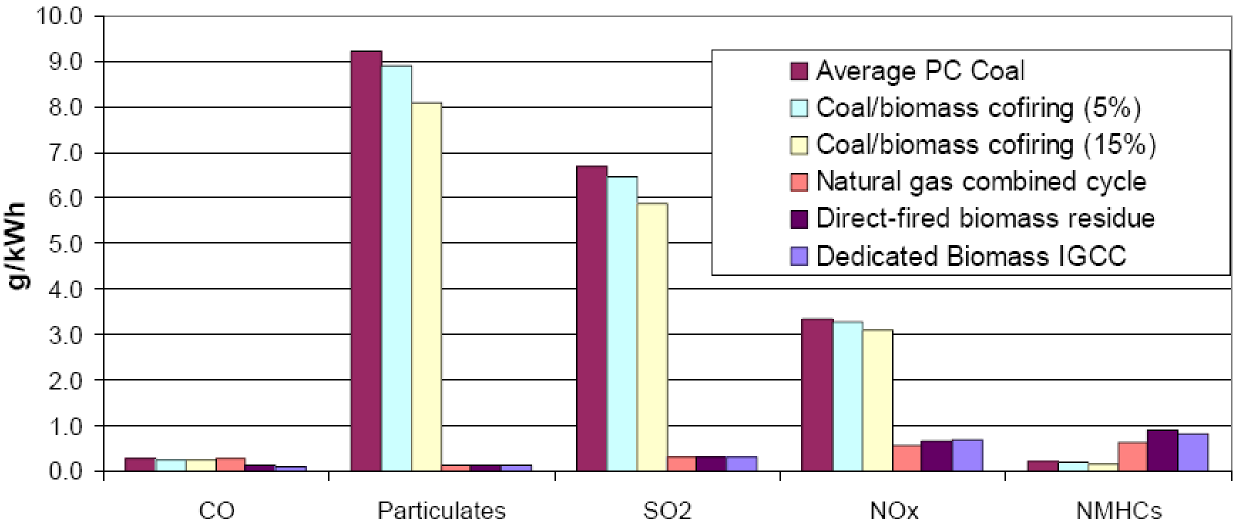
[54] http://www.fuelsforschools.info/pdf/MemoSummary.pdf, page 5.

[55] Ibid, page 10.

[56] Ibid, page 6-7.

[57] "A Comparison of the Environmental Consequences of Power from Biomass, Coal, and Natural Gas," Mann, Margaret K. and Pamela L. Spath, National Renewable Energy Laboratory.

**Figure 10: Biomass Emissions.**
*Source: National Renewable Energy Laboratory*




## Mitigating Emissions: Combustion Efficiency

As previously discussed, the efficiency of a combustion system appears to affect its rate of emissions. Combustion efficiency may be impacted by the system's overall size, combustion controls, instrumentation to monitor combustion performance, fuel moisture, boiler and pipe insulation, and the presence of multiple boilers.[58] The following explanation of the operation and efficiency of a direct-burn boiler and a two-chamber boiler are taken from a report entitled "Information on Air Pollution Control Technology For Woody Biomass Boilers, March 2009" and published by the U.S. Departments of Interior and Agriculture and their cooperating land management agencies at www.forestsandrangelands.gov.

❑ Direct-burn Boiler

A direct-burn boiler has a single combustion chamber that is usually located directly under the boiler on a specially designed base shown in **Figure 11**. Air is injected into this chamber both below and above the grates where the wood is burned.

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[58] "Controlling Emissions from Wood Boilers", Northeast States for Coordinated Air Use Management, October 2008.

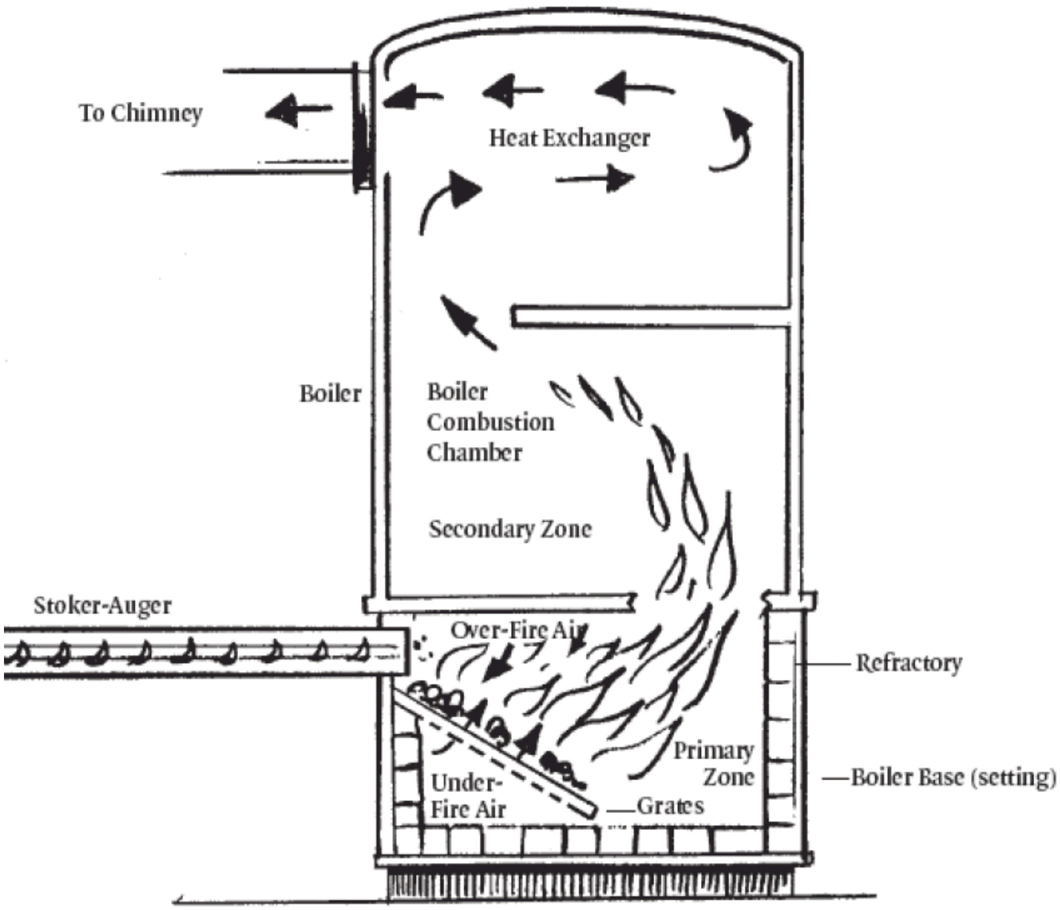



**Figure 11: Single-Chamber Combustion.**
*Source: www.forestsandrangelands.gov*

In some designs, the boiler is open to the combustion chamber, which sits above it. The hot gases rise up from the grate area into the combustion chamber, where combustion of the hot gases and solid combustible particles is completed. The hot exhaust gases then pass into the heat exchanger. When such systems are used to burn high moisture content wood, they can be prone to incomplete combustion, which increases emissions of fine particles and toxic pollutants.

In other direct-burn designs, there is a refractory baffle separating the primary and secondary combustion zones. The baffle is used to enclose the primary combustion area above the grates, increasing primary zone temperature and lengthening the flame path to give more time for the carbon in the hot gases to oxidize completely. This also burns better in low fuel load conditions. In general, these design changes can improve the likelihood of more complete combustion and lower emissions of fine particles and toxic pollutants.

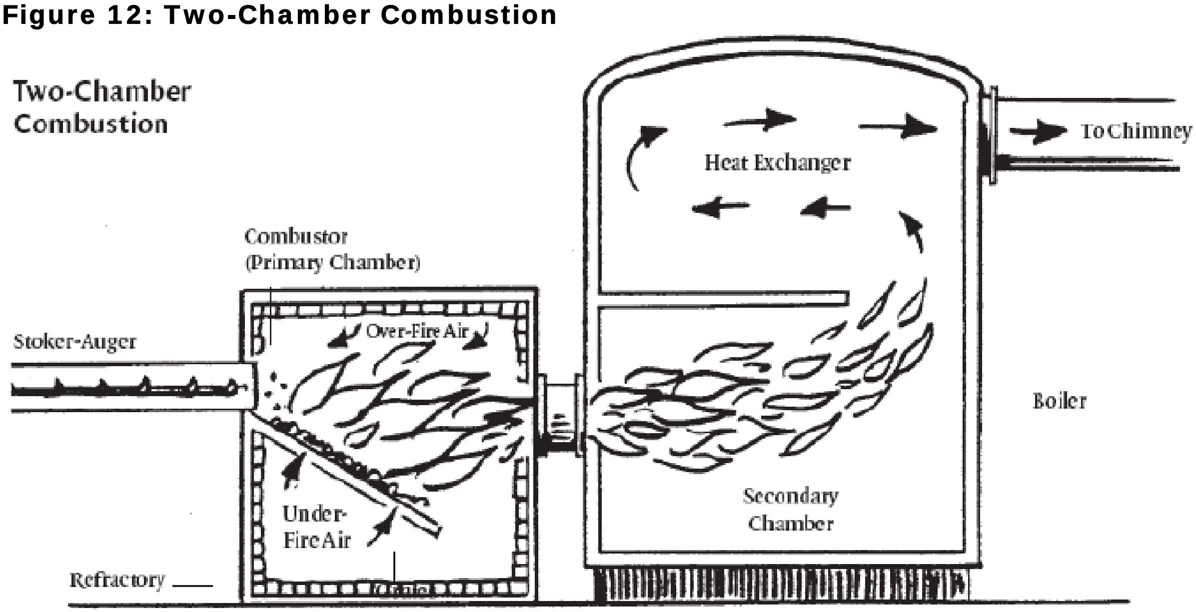
In a mechanical forced-draft direct-burn system, however, unless the base and access doors of the boiler are effectively sealed, it can be difficult to limit the introduction of unintentional air to the combustion chamber. This can result in high excess air levels, decreased efficiency, and increased emissions of fine particles and toxic pollutants.

Direct-burn systems have a simpler design and may cost less than two-chamber boilers. If direct-burn systems are properly designed with effective combustion controls, they are capable of highly efficient combustion and reduced emission levels.

❑ Two-Chamber Boiler

In two-chamber systems, a separate refractory lined combustion chamber sits next to the boiler, connected by a short horizontal passage or blast pipe that is also refractory-lined as shown in **Figure 12**. Hot gases from the combustor pass through the blast tube or directly into the combustion chamber of the boiler itself so that the boiler's combustion chamber becomes the secondary chamber of the combustion system.

**Figure 12: Two-Chamber Combustion**




Two-chamber systems have been used to burn both high-moisture and low-moisture biomass fuels and are frequently used with high-moisture fuels like green softwood. Because the boiler is typically more insulated and sized smaller in relation to the heat load, these systems may achieve and maintain high temperatures in the primary combustion zone even when the fuel has a moisture content of greater than 50%.

The combustor of a two-chamber system is generally airtight to limit the amount of oxygen available for combustion. Excess air can cool the fire and reduce efficiency. Two-chamber systems are designed to prevent unintentional air or “tramp air” from entering the combustor with the fuel. The control of primary and secondary air and the elimination of tramp air allow control of combustion in the primary chamber. Regulation of boiler temperature is critical because sustained high gas temperatures are needed to achieve complete combustion. A potential advantage of two-chamber systems is that they can have longer flame paths, more turbulence (for mixing oxygen with combustible gases) and longer retention times of high-temperature gases. The longer the flame path and retention time, the more complete the combustion of the gasified fuel. This more efficient combustion reduces fine particle emissions and increases energy production.

Two-chamber systems that produce high gas temperatures in the secondary chamber need carefully matched heat exchangers to extract enough energy from the hot flue gases. If the heat exchanger is undersized, the stack temperature will be too high and excessive heat energy will go up the stack. This will reduce the system’s efficiency and indirectly result in increased emissions due to the increased fuel use from the lower system efficiency.

A close-coupled gasifier is a type of two-chamber system in which the combustion air in the primary chamber is restricted so that the wood gases produced are prevented from burning completely in the combustor. Final combustion air is added to the blast tube or the first chamber to increase turbulence and produce high gas temperatures entering the secondary chamber. Close-coupled gasifiers are characterized by lower primary combustion temperatures, a relative absence of visible flame in the primary chamber, and higher temperatures in the secondary chamber. A potential advantage of this technology over conventional boiler combustion is that by separating the gasification and combustion zones and using air injection to increase turbulence, fuel may dry more completely and burn more efficiently at higher temperatures resulting in lower levels of fine particles and toxic pollutants.

A computer-based combustion control system is critical to ensuring proper combustion. The control system receives its basic information from a data acquisition system that consists of computer hardware and related software. The system reads signals from various process monitors (temperature thermocouples, $O_2$ sensors, pressure gauges, and flow meters) and then adjusts the various process controls to maintain optimum operating conditions throughout the operating range.[59]

## Mitigating Emissions: Control Technologies

This summary of potential control technologies shown in **Table 16** was developed by the Healthy Forests and Rangelands project administered by the U.S. Departments of Interior and Agriculture using data from the Northeast States for Coordinated Air Use Management (NESCAUM), an association of state air quality agencies.

**Table 16: Emission Control Technologies**

| Control | Removal Effectiveness | Installation cost | Comments |
|---|---|---|---|
| Cyclone | PM 10 - 50%<br>PM 2.5 - up to 10% | $7k-10k | Easy to use/maintain, little space required, inexpensive. Creosote may condense on cyclone. |
| Multicyclone | PM 10 - 75%<br>PM 2.5 - up to 10% | $10k-16K | Easy to use/maintain, little space required, inexpensive. Requires more fan energy, creosote may condense on cyclone. |
| Core Separator | PM 10 - >90% | $83k for 24 inch<br>$130K for 12 inch | Easy to use. Ineffective at removing condensable PM. Performance differs on size, questionable availability, lack of independent performance tests. |
| Baghouse/ Fabric Filter/ Cyclone | PM 10 - 99%<br>PM 2.5 - 95-99% | $85k-105k for 10-15mmBtu/hr | Highly effective at collecting fine and condensable PM. Collection performance can be monitored. Critical to combine bag house with cyclone to reduce fire risk. High flue gas temps must be cooled, condensation of exhaust gas may plug bags. Replace bags every 2-3 years. |
| Electrostatic Precipitator | PM 10 - 90-99%<br>PM 2.5 - 90-95% | $90k-100k for 1-5 mmBtu/hr<br><br>$100k-175k for 10 mmBtu/hr | Easy to use. Ineffective at removing condensable PM. Can be operated at high temps. Power requirements & pressure drops lowest compared to other high efficiency collectors. |

59 http://www.forestsandrangelands.gov/Woody_Biomass/documents/bioenergy/woody_biomass_control_technology_032509.pdf

A 2008 report published on the NESCAUM website[60] found that the current use of emission controls on wood boilers in the United States is limited and has seen incremental advancement, compared to Europe. The report went on to say that use of advanced biomass emission controls in the U.S. is rare and typically involves fabric filters. The lack of progress and market penetration for the development of control technologies in the U.S. was attributed, in part, to the small market for controls for these systems and to the fact that most units don't trigger state permitting thresholds.[61]

In a comparison of particulate matter emission standards in the U.S. and Europe, it was found that European standards are commonly 12 to 30 times more stringent than those in the U.S.[62] Montana's PM emission standard for a facility less than 10 MMBtu, like Darby, Victor, and Townsend, is 11 times less stringent than allowable PM emissions in Austria, Germany, The Netherlands, Sweden, and Switzerland. Germany, meanwhile, is expected to lower its emission threshold in 2015 to a level that would be 30 times more stringent than Montana's.

The comparison of emission standards was included in a study submitted to the Massachusetts Department of Energy Resources in June 2009, which found that the PM 2.5 emissions performance of European wood-fired boilers is considerably better than those in the U.S.[63] The report states that even without post combustion flue gas treatment, such as an electrostatic precipitator listed in **Table 16**, the European boilers emit levels that U.S. units can only meet with advanced emission control devices. The European units are achieving 90% greater reduction in emission levels compared to older technologies used in the U.S.[64]

The higher performance of the European wood-fired boilers is attributed to their design characteristics, which include two stages of combustion, a powered air supply with variable speed controls, and oxygen sensors in the flue gas stream to

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[60] http://www.nescaum.org/topics/commercial-wood-boilers

[61] "Controlling Emissions from Wood Boilers", Northeast States for Coordinated Air Use Management, October 2008.

[62] "Biomass Boiler & Furnace Emissions and Safety Regulations in the Northeast States, Evaluation and Options for Regional Consistency",CONEG Policy Research Center, June 2009, pages 7-8.

[63] Ibid, page 9.

[64] Ibid.

maximize energy efficiency and minimize PM 2.5 and CO emissions.[65] The design is meant to ensure a complete burnout of all hydrocarbons and to minimize ash. Impediments to importing European wood-fired boilers in the U.S. appear to be differences in safety and emissions testing and emission standards.[66]

- The study submitted to the Massachusetts Department of Energy Resources concluded that an expanded market for biomass furnaces and boilers in the U.S. would require higher efficiency, lower emission biomass heaters and boilers. The report stated that the availability of these systems would be significantly enhanced by the establishment of consistent, lowest-achievable air emission standards to reduce pollution and public health impacts. To this end, the researchers suggested that the state could:
- participate in EPA rulemaking to establish an area source rule and maximum achievable control technology;
- extend regulatory emission efforts to residential units;
- work to stimulate the market by identifying and supporting incentives to fund retrofits and change out existing boilers;
- encourage the adoption of efficiency requirements for U.S. manufactured biomass technologies; and
- work with economic development agencies and European manufacturers to promote the production of European technologies in the United States.[67]

## DEQ Permitting Discussions

Simultaneous with the EQC's biomass discussion, the DEQ's Air Resources Management Bureau and representatives of the biomass industry began reviewing permitting requirements for wood grinders and chippers. The DEQ hosted a meeting in April 2010 that included representatives from DEQ, DNRC, Montana Logging Association, Montana Wood Products Association, John Jump Trucking, Johnson Brothers, and Marks Lumber. Members discussed how permitting is applicable to chippers and grinders, opportunities for flexibility in regulation, and the overall permitting structure.

The regulation of wood grinders is not a new issue. Currently, there are estimated to be about a dozen grinders and chippers with various technologies operating in

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[65] Ibid.

[66] Ibid, page 2.

[67] "Biomass Boiler & Furnace Emissions and Safety Regulations in the Northeast States, Evaluation and Options for Regional Consistency",CONEG Policy Research Center, June 2009, pages 23-24.

Montana. Of those, six portable wood grinders are permitted by DEQ. To acquire a permit, an operator pays a $500 application fee and an $800 annual operating fee. A public notice is also required. In Montana, the state regulates stationary emission sources, including "portable" sources. The state also must ensure that its regulations comply with federal air quality requirements. The state does not require permits for "mobile" sources. Mobile sources are considered to be planes, trains, and automobiles. Portable sources are considered to be gravel crushers and other comparable items. The wood grinder discussion showed that the difference between mobile and portable isn't black and white.

The DEQ historically viewed wood grinders and chippers, considered to be portable, as requiring a state permit. Industry representatives said they believe a number of grinders should be considered mobile sources, not requiring a permit, because the equipment is self-propelled. Stakeholders requested the EQC to clarify the discussion with a legislative solution. The EQC responded by requesting staff draft LC 7000.

## Conclusion

The development of biomass energy from forestry and agricultural residues can create significant economic activity throughout Montana. The activity would include not only power and heat generation but also new jobs. Biomass development, however, includes a significant capital investment, and successful development often requires some public-private partnerships. The EQC in conducting its biomass study worked with both private developers, including sawmill owners and electricity and heat suppliers, and public entities, such as the DNRC and DEQ.

As the EQC worked toward its findings and recommendations, members reviewed a series of discussion points prepared by staff as well as points shared by the DNRC. That information is included in **Appendix O**. The EQC also accepted public comment on biomass proposals during the month of June and the month of August. Those public comments are posted online at www.leg.mt.gov/eqc and copies are available in the Legislative Environmental Policy Office. Using the discussion points and public comment, the EQC ultimately reached findings and recommendations related to biomass availability and the importance of advancing biomass.

# Appendix A



A JOINT RESOLUTION OF THE SENATE AND THE HOUSE OF REPRESENTATIVES OF THE STATE OF MONTANA REQUESTING AN INTERIM STUDY TO EVALUATE THE FEASIBILITY OF EXPANDED USE OF BIOMASS FEEDSTOCKS FOR ENERGY USE IN MONTANA.

WHEREAS, the expanded use of biomass from forests, agriculture, and other sources for energy may provide substantial economic and environmental benefits to Montanans; and

WHEREAS, the Environmental Quality Council, in conducting a climate change interim study during the 2007-08 interim, identified the expanded use of biomass feedstocks for energy use in Montana as a potentially important policy directive that deserves further evaluation.

NOW, THEREFORE, BE IT RESOLVED BY THE SENATE AND THE HOUSE OF REPRESENTATIVES OF THE STATE OF MONTANA:

That the Legislative Council be requested to designate an appropriate interim committee, pursuant to section 5-5-217, MCA, or direct sufficient staff resources to:

(1) evaluate the feasibility of expanding the Alternative Energy Revolving Loan Program for biomass feedstock projects;

(2) evaluate Montana biomass feedstock tax incentives as well as other state biomass feedstock tax incentives with respect to reducing the capital costs of biomass energy production, including electricity generation and heating of residences and public buildings;

(3) analyze the potential use of pilot projects for different forestry and agriculture residues and liquid fuel production;

(4) evaluate funding alternatives for research and development on techniques for the collection, processing, transportation, storage, and distribution of forestry and agriculture residues, as well as market development or expansion for these materials;

(5) document research that has been conducted to:

(a) characterize emissions from biomass boilers and the impacts those emissions have on community air pollution; and

(b) mitigate emission impacts;

(6) evaluate the statutory impediments to Renewable Resource Grant and Loan Program eligibility for biomass feedstock projects, if any; and

(7) (a) evaluate the availability of the forest biomass resource in Montana from a biological, administrative, and economic standpoint; and

(b) evaluate available biomass resources against existing biomass consumption to determine the forest biomass balance.

BE IT FURTHER RESOLVED, that if the study is assigned to staff, any findings or conclusions be presented to and reviewed by an appropriate committee designated by the Legislative Council.

BE IT FURTHER RESOLVED, that all aspects of the study, including presentation and review requirements, be concluded prior to September 15, 2010.

BE IT FURTHER RESOLVED, that the final results of the study, including any findings, conclusions, comments, or recommendations of the appropriate committee, be reported to the 62nd Legislature.

- END -

# Appendix B

**Biomass Study Work Plan Tasks**:

x  1. Pilot projects proposals and needs. Review of projects initiated with Department of Commerce dollars or otherwise.
Who: EQC staff, Department of Commerce staff
Time line: September 2009 meeting

x  2. Updates on recent federal biomass efforts.
Who: DNRC, Department of Commerce and Agriculture staff
Time line: September 2009 meeting

x  3. Overview of biomass incentives, and role of states in funding and/or promoting biomass in other Western states.
Who: EQC staff
Time line: September 2009 meeting

x  4. Update on pilot projects.
Who: EQC staff
Time line: January 2010 meeting

x  5. Review of biomass technologies and availability in Montana.
Who: EQC staff
Time line: January 2010 meeting

x  6. Panel discussion from stakeholders.
Who: Biomass developers, researchers, land managers, and utilities.
Time line: September and January 2010 meeting

x  7. EQC discussion and study direction.
Who: EQC members
Time line: January 2010 meeting

x  8. Overview of research and development with focus on needs and barriers specific to Montana.
Who: EQC staff
Time line: January 2010 meeting

x  9. Review existing incentives, loan programs, and biomass projects in Montana. Discussion of utility tie-in aspects.
Who: EQC staff
Time line: January 2010 meeting

x  10. Summary of biomass emissions research.
Who: EQC staff
Time line: March 2010 meeting

x 10. Presentation of preliminary report and development of recommendations and proposed legislation.
Who: EQC members, staff
Time line: March 2010 meeting

x 11. Review draft report, findings, recommendations, and any proposed legislation.
Who: EQC members, staff
Time line: May 2010 meeting

x 12. Review public comment on draft report and any proposed legislation.
Who: EQC members, staff
Time line: July 2010 meeting

x 13. Approval of final report and any findings, recommendations, or legislation.
Who: EQC members
Time line: September 2010 meeting

**Unofficial Draft Copy**
As of: September 15, 2010 (11:44am)

LC7000

**** Bill No. ****

Introduced By *************

By Request of the Environmental Quality Council

A Bill for an Act entitled: "An Act clarifying the powers of the board of environmental review related to air quality permitting and rulemaking for forestry equipment; amending section 75-2-111, MCA; and providing an immediate effective date."

Be it enacted by the Legislature of the State of Montana:

**Section 1.** Section 75-2-111, MCA, is amended to read:

**"75-2-111. Powers of board.** The board shall, subject to the provisions of 75-2-207:

(1) adopt, amend, and repeal rules for the administration, implementation, and enforcement of this chapter, for issuing orders under and in accordance with 42 U.S.C. 7419, and for fulfilling the requirements of 42 U.S.C. 7420 and regulations adopted pursuant to that section, except that, for purposes other than agricultural open burning, the board may not adopt permitting requirements or any other rule relating to:

(a) any agricultural activity or equipment that is associated with the use of agricultural land or the planting, production, processing, harvesting, or storage of agricultural crops by an agricultural producer and that is not subject to the requirements of 42 U.S.C. 7475, 7503, or 7661a; ~~or~~

(b) a commercial operation relating to the activities or equipment referred to in subsection (1)(a) that remains in a single location for less than 12 months and is not subject to the requirements of 42 U.S.C. 7475, 7503, or 7661a; or

(c) except when used in an incorporated city or town, a wood chipper, wood grinder, or other forestry equipment and its associated engine used for forestry practices that remains in a single location for less than 12 months and is not subject to the requirements of 42 U.S.C. 7475, 7503, 7661a;

(2) hold hearings relating to any aspect of or matter in the administration of this chapter at a place designated by the board. The board may compel the attendance of witnesses and the production of evidence at hearings. The board shall designate an attorney to assist in conducting hearings and shall appoint a reporter who must be present at all hearings and take full stenographic notes of all proceedings, transcripts of which will be available to the public at cost.

(3) issue orders necessary to effectuate the purposes of this chapter;

(4) by rule require access to records relating to emissions;

(5) by rule adopt a schedule of fees required for permits, permit applications, and registrations consistent with this chapter;

(6) have the power to issue orders under and in accordance with 42 U.S.C. 7419."

{*Internal References to 75-2-111: 75-2-221x*}

NEW SECTION. **Section 2. {standard} Effective date.** [This act] is effective on passage and approval.

- END -

{Name : Sonja E. Nowakowski
Title : Research Analyst
Agency: LSD LEPO
Phone : 406-444-3078
E-Mail: snowakowski@mt.gov}

# ENVIRONMENTAL QUALITY COUNCIL

**PO BOX 201704**
**HELENA, MONTANA 59620-1704**
**(406) 444-3742**



September 14, 2010

Governor Brian Schweitzer
Office of the Governor
Montana State Capitol Bldg.
P.O. Box 200801
Helena MT 59620-0801

Dear Governor Schweitzer,

On behalf of the Legislative Environmental Quality Council (EQC), we are writing to encourage your office and the Montana University System to assist the Legislature in its efforts to promote the use of biomass-based energy development in Montana. The EQC, in conducting its climate change study during the 2007-08 Interim, identified the expanded use of biomass feedstocks for energy use in Montana as a potentially important policy directive that deserved further evaluation and brought forward House Joint Resolution No. 1, which was approved by the 2009 Legislature. Over the last 16 months, the EQC has focused on H.J. 1 and the use of forestry and agricultural residues as a feedstock for heat and electricity. We feel the work being done by Montana's Agricultural Experiment Station and Extension Service is critical to advancing the use of agricultural biomass across Montana.

A high-level, statewide assessment of biomass availability for Montana developed by the U.S. Department of Energy, Energy Efficiency and Renewable Energy Office finds there are 4.3 million dry tons of cellulosic biomass available in the state, along with 0.1 million dry tons of total crop biomass. Researchers at Montana State University's College of Agriculture and the Montana Agricultural Experiment Station are conducting research looking at how to advance biobased products for fuel, heat, and electricity in Montana. For example, researchers at the Ag Research Center in Moccasin are working to develop cropping systems to maximize plant biomass production and oilseed yield, and researchers in the College of Agriculture and College of Engineering are looking at using agricultural crop residue as an alternative to wood for pellet fuels used in residential stoves and commercial boilers. We applaud these efforts.

We are discouraged to learn of the funding reductions at Montana's Agricultural Experiment Station and the Montana State University Extension. It is our understanding that cuts are likely in areas of research focused on bio-energy, climate change, infectious disease, and biological control of weeds. We are deeply concerned about the impact these cuts will have on Montana's seven agricultural research centers and their ability to conduct in-depth studies, scientific investigations, and experiments.

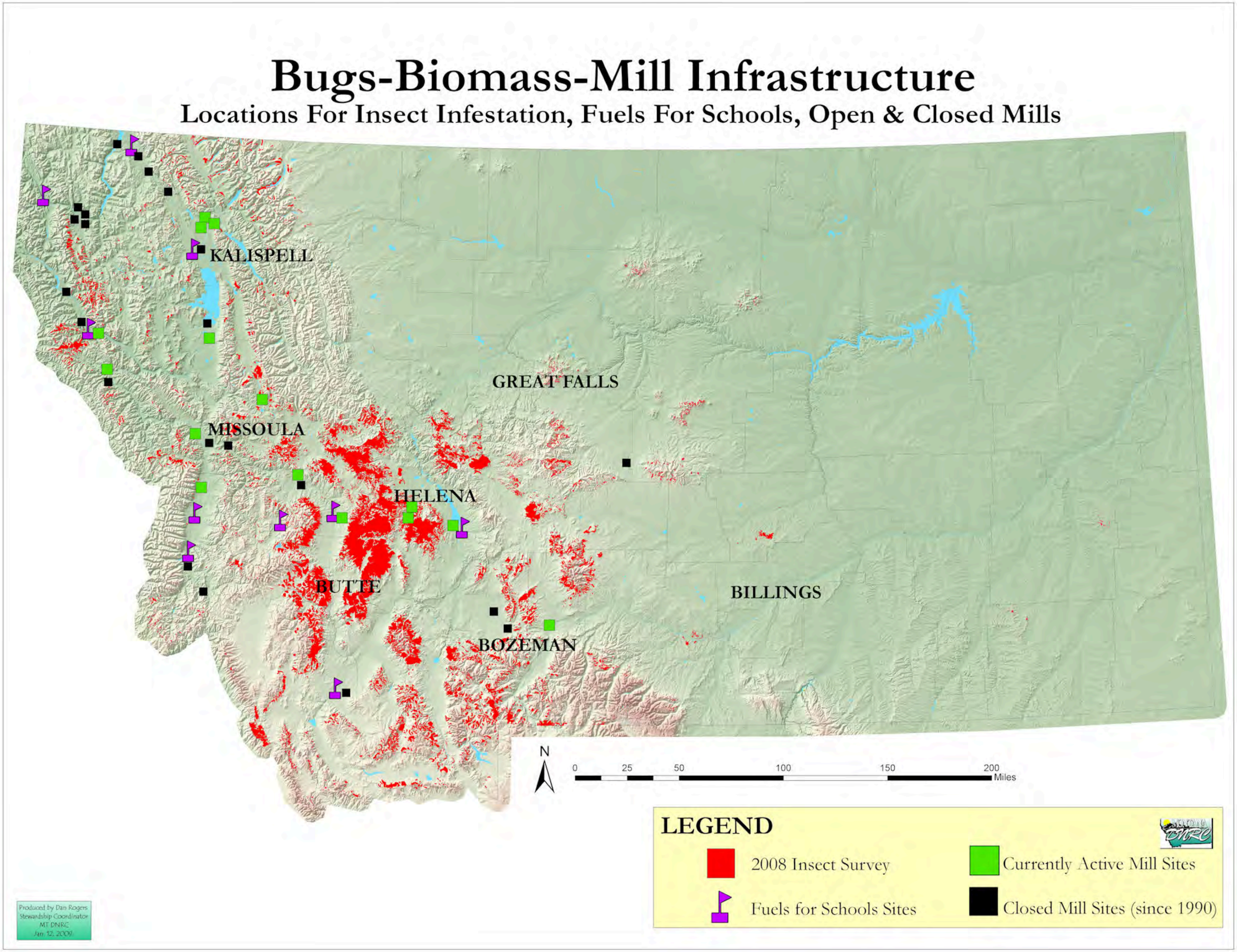
While recognizing the necessity to address falling state revenues, we encourage the Governor's Office and the Montana Board of Regents to maintain a strong level of support for Montana's Agricultural Experiment Station and Montana State University Extension.

Sincerely,

Chairman Chas Vincent

Vice-chairman Bradley Maxon Hamlett

cc.
Commissioner of Higher Education Sheila Stearns
Senator Max Baucus
Senator Jon Tester
Representative Dennis Rehberg



Bugs-Biomass-Mill Infrastructure
Locations For Insect Infestation, Fuels For Schools, Open & Closed Mills
KALISPELL
GREAT FALLS
MISSOULA
HELENA
BUTTE
BILLINGS
BOZEMAN
N
0
25
50
100
150
200
Miles
LEGEND
2008 Insect Survey
Currently Active Mill Sites
Fuels for Schools Sites
Closed Mill Sites (since 1990)

Viable small-scale biomass projects awaiting funding for construction:

| Facility | City | Estimated Project Cost | Estimated Grant Funding Needed to Proceed |
|---|---|---|---|
| University of Montana, Missoula | Missoula | $5-10 million | $2.5 million |
| Clark Fork Valley Hospital | Plains | $500,000 | $175,000 |
| Marcus Daly Memorial Hospital | Hamilton | $1.5-3.5 million | $560,000 |
| Libby School District | Libby | $700,000 | $250,000 |
| Corvallis School District | Corvallis | $1.2 million | $350,000 |
| Polson School District | Polson | $0.5 -1 million | $275,000 |
| Two Eagle River School | Pablo | $700,000 | $250,000 |
| Stevensville School District | Stevensville | $750,000 | $250,000 |
| Dillon Middle School | Dillon | $750,000 | $250,000 |
| Dillon Parkview Elementary | Dillon | | |
| Browning High School | Browning | $650,000 | $200,000 |
| Potomac School | Potomac | $600,000 | $200,000 |
| **Total Grant Funding Needed to Proceed** | | | **$5,260,000** |
| | | | |
| **Projects currently under analysis** | | | |
| Kalispell District Heating | Kalispell | TBD | TBD |
| Anaconda District Heating | Anaconda | TBD | TBD |
| Boulder School | Boulder | TBD | TBD |
| Mineral County Hospital | Superior | TBD | TBD |
| Superior High School | Superior | TBD | TBD |

## Appendix E

# ENVIRONMENTAL QUALITY COUNCIL

**PO BOX 201704**
**HELENA, MONTANA 59620-1704**
**(406) 444-3742**



June 10, 2009

Department of Commerce
Director Anthony Preite
301 S. Park Avenue
P.O. Box 200501
Helena, MT 59620-0501

Dear Director Preite,

On behalf of the Legislative Environmental Quality Council (EQC), I am writing to urge your office to use the resources dedicated to a "Biomass Energy Study" by the 2009 Legislature specifically to establish biomass pilot projects in Montana. With the approval of House Bill No. 645, the 2009 Legislature allocated $475,000 to the Department of Commerce for this study. The only legislative parameters for using the money are that the money may be used to fund biomass project feasibility studies, to install biomass energy boilers, or to provide for biomass program staff within the Department of Natural Resources and Conservation to increase biomass utilization.

Because of the volume of biomass research and study already taking place in Montana, as discussed in this letter, Council members believe the $475,000 directed to the Department of Commerce should not be used for additional broad-based study, but instead should be specifically targeted to assist in bringing to fruition one or more biomass pilot projects that demonstrate the feasibility of commercial biomass endeavors in Montana.

The 2009 Legislature approved House Joint Resolution No. 1, directing a legislative committee to study biomass feasibility. The EQC requested the study resolution following the 2007-08 interim, identifying the expanded use of biomass feedstocks for energy as an important policy directive that deserved further evaluation. Council members, during a meeting May 28-29, tentatively agreed to dedicate a sizeable amount of their time during the next 16 months to evaluating biomass technologies, availability, and ultimately expanding biomass utilization in Montana. The EQC would like to focus its efforts in a manner that is useful to the Department in advancing pilot projects.

In May 2008, the EQC wrote to Commissioner of Higher Education Sheila Stearns, encouraging the Montana University System (MUS) to continue its existing research and programs in the area of biomass. The EQC requested a report from MUS on its biomass research activities and recommendations about the feasibility of the collection, processing, transportation, storage, and distribution of forestry and agricultural residues. The EQC also is aware of a recently released study conducted by the Bureau of Business and Economic Research at the University of Montana that discusses biomass availability in Montana.

In conducting its work over the interim, the EQC intends to engage in a broad, comprehensive analysis that will be inclusive of all interested entities currently researching biomass opportunities, as well as the stakeholders that will be impacted by its successful application. We move forward with optimism based on a few assumptions:

- Biomass can be sourced locally, from within Montana, contributing to the security of the state's energy supply while reducing the threat of catastrophic wildfire, addressing the need for restorative balance to healthy watersheds and ecosystems, and helping ensure the viability of Montana's struggling timber industry.
- Montana sourced energy generation using biomass offers many diverse, local, business opportunities, supports Montana's economy, and will advance local, state, and national policies in biomass utilization.
- Montana has a unique opportunity to actively participate in these policy discussions nationwide by showcasing successful implementation of biomass projects.

Director Preite, the EQC appreciates the time and attention you and your staff give these matters. We look forward to working with you in the coming months. Please let me know if I, or the EQC staff, can be of assistance.

Sincerely,

Representative Chas Vincent

EQC Chairman

# Biomass Feasibility Study Report

Porter Bench Energy LLC
Interim Briefing to
Environmental Quality Council

May 6, 2010

Porter Bench Energy LLC

Energy Promotion and Development Division

# Study Elements

- Woody biomass fuel assessment
- Typical biomass plant
- Permitting considerations
- Site assessments
- Financial feasibility

Porter Bench Energy LLC

Energy Promotion and Development Division

# Fuel Assessment Overview

- Coordination with Northwest Energy and DNRC
  - Data requests
  - Analysis methodology
- Data obtained from USFS, BLM, Montana DNR and Kootenai/Salish Tribes
- Area wide analysis and four site specific analyses

Porter Bench Energy LLC

Energy Promotion and Development Division

## Biomass Data Screens

Requested data screens based on accessibility:

- Lands with less than 40% slope
- USFS data from wildland/urban interface area, excluding old growth
- BLM data for lands outside of Wilderness Study Areas
- BIA data for non-reserved lands
- State lands data for non-deferred land only

Basis of overall Montana biomass availability

Porter Bench Energy LLC

Energy Promotion and Development Division

# Specific Area Analyses

- Analysis of data received within 40 and 70-mile working circles around 4 different areas in western Montana
- Estimated
  - all available woody biomass
  - Biomass from non-federal sources

Porter Bench Energy LLC

Energy Promotion and Development Division

# Other Woody Biomass Sources

- Unused logging residue
- Mill residue
- Municipal solid waste (i.e. discarded construction lumber, etc.)
- Utility corridors clearing

Porter Bench Energy LLC

Energy Promotion and Development Division

# Typical Biomass Plant

Requirements

- Power plant acreage
- Fuel storage and processing area
- Road access
- Water (30,000 gal/hour)
- Labor
- Transmission line

Porter Bench Energy LLC

Energy Promotion and Development Division

# Schematic Inputs and Outputs

## Inputs

- Fuel Supply
- Water
- $NH_3$, Limestone
- Labor

## Outputs

- Wastewater: Salinity, Phosphorus, Nitrogen, Chlorine, Zinc *
- Energy
- Ash
- AQ Pollutants: $CO_2$, $PM_{10}$, $PM_{2.5}$, HCl, NO *

* Subject to controls.

Porter Bench Energy LLC

Energy Promotion and Development Division

# Rationale for 60 MW Plant

- Uses most economical plant technology
- Has faster overall permitting process in view of Dec 2010 expiration of federal production tax credits
- Larger plants require more fuel with resulting higher transportation costs
- Does not qualify as a power generator
- Smaller plants cost more per megawatt

Porter Bench Energy LLC

Energy Promotion and Development Division

# Capital and O&M Costs, Labor for 60 MW Plant

Costs

- Capital costs $180,000,000
- O&M costs $7,570,000

Labor and Jobs

- 500 construction jobs
  - Average of 60 to 70 on-site
  - Peak of about 150 on-site
- Plant operations
  - 45 to 55 people
- Fuel harvesting/delivery
  - Up to 400 people

Porter Bench Energy LLC

Energy Promotion and Development Division

# Permitting Considerations

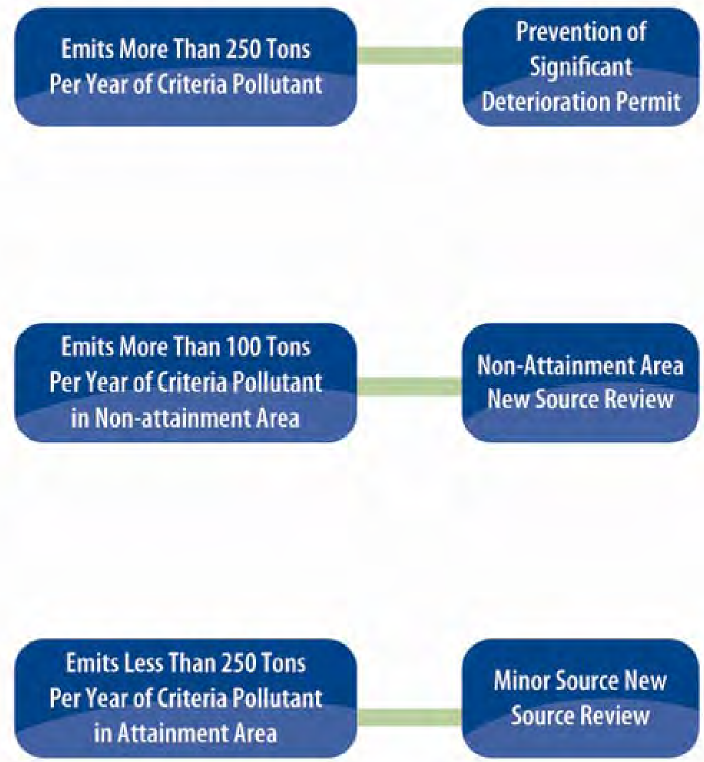
## Water Quality

- Placement of discharge water
- Status of impairment of adjacent surface waters
- Ground water permitting

## MEPA

## Federal Nexus to NEPA

## Air Quality Permitting




Porter Bench Energy LLC

Energy Promotion and Development Division

# Case Law Challenging Biomass Plants

Basis of current challenges:

- Air quality and greenhouse gas emissions
- Forest management and sustainability
- Truck traffic and noise
- Water use and water quality
- Level of applicable environmental review

Primary risk to projects – delay and cost

Porter Bench Energy LLC

Energy Promotion and Development Division

# Site Assessment

- 17 potential sites identified collectively by DOC, PBE and Northwest Energy
- Sites divided between PBE and Northwest Energy
- Nine potential sites evaluated by PBE based on:
    - Proximity and volume of biomass fuel
    - Water availability
    - Access to power grid
    - Fuel storage area
    - Water and ash disposal
    - Air shed characteristics
    - Proximity of rail
    - Workforce and worker housing proximity

Porter Bench Energy LLC

Energy Promotion and Development Division

# Financial Feasibility Pro Forma

- Based on a 60 MW plant using fuel only from non-federal lands
- $180,000,000 capital cost
- Above average risk premium = higher debt costs
- Fuel supply cost and Power Purchase Agreement
- Governmental and policy risks

KEY CONCLUSION:

– Requires legislative mandates to purchase Renewal Energy Credits (REC) to be financially feasible

Porter Bench Energy LLC

Energy Promotion and Development Division

# Preliminary Conclusions

- Is sufficient biomass but majority is on Federal lands and is not considered accessible.
- Is conservative approach to site feasibility as considers only non-federally based biomass
- Is substantial potential job creation (considerable construction jobs, on-site employment, and biomass production/transport jobs)
- Requires careful plant design to address air quality and water quality issues and facilitate permitting
- ***Feasibility requires state legislative action to mandate purchase of Renewable Energy Credits***

Porter Bench Energy LLC

Energy Promotion and Development Division

# Appendix G

| Montana Biomass Working Group Members and Interested Parties | |
|---|---|
| | |
| **Name** | **Affiliation** |
| **Members** | |
| Julia Altemus | DNRC Forest Policy |
| Angela Farr | USFS Biomass Utilization Program |
| Nick Leslie | DOC Energy Promotion and Development |
| Howard Haines | DEQ Energy Bureau |
| Joe Kerkvliet | The Wilderness Society |
| Julie Kies | DNRC Biomass Utilization |
| Rich Lane | Camas Creek Enterprises/Missoula Area Economic Development Corp. |
| Carla Monismith | USFS |
| Todd Morgan | UM Bureau of Business and Economic Research |
| Craig Rawlings | MT Community Development Corp. |
| Chuck Roady | Montana Wood Products Association |
| Ellen Simpson | Montana Wood Products Association |
| Brian Spangler | DEQ Energy Bureau |
| Shawn Thomas | DNRC Trust Lands Division |
| John Thompson | BLM |
| Martin Twer | MSU Extension Forestry |
| Roger Ziesak | DNRC Forest Practices |
| | |
| **Harvest Guidelines Sub-Group** | |
| Julia Altemus | DNRC Forest Policy |
| Len Broberg | Sierra Club/Environmental Studies, University of Montana |
| Rob Ethridge | DNRC Forestry Assistance Bureau Chief |
| Angela Farr | USFS Biomass Utilization Program |
| Steve Hayes | UM Bureau of Business and Economic Research |
| Joe Kerkvliet | The Wilderness Society |
| Julie Kies | DNRC Biomass Utilization |
| Paul McKenzie | Tree Farm, Stoltze Land and Lumber |
| Carla Monismith | USFS |
| Todd Morgan | UM Bureau of Business and Economic Research |
| Jeff Schmalenberg | DNRC Soil Scientist |
| Brian Sugden | Plum Creek |
| Shawn Thomas | DNRC Trust Lands Division |
| Jason Todhunter | Montana Logging Association |
| Martin Twer | MSU Extension Forestry |
| Meredith Webster | USFS Soil Scientist |
| Roger Ziesak | DNRC Forest Practices |
| | |
| **Technical Advisors** | |
| Greg Jones | Rocky Mtn. Research Station, USFS |

| | |
|---|---|
| Paul McKenzie | Tree Farm, Stoltze Land and Lumber |
| Meredith Webster | USFS Soil Scientist |
| | |
| **Observers** | |
| David Atkins | USFS |
| Alison Berry | Sonoran Institute |
| Beth Dodson | University of Montana, College of Forestry and Conservation |
| Jim Durglo | Confederated Salish and Kootenai Tribal Forestry |
| Peter Kolb | MSU Extension Forestry |
| Jim Kranz | Plum Creek; Montana Forest Council |
| Kim Mathews | Private landowner, Trout Creek, MT |
| Sonja Nowakowski | EQC, Legislative Services Division |
| Jenny O'Mara | DEQ Air Permitting Section |
| Jim Peterson | Evergreen Magazine |
| Chris Pileski | DNRC Eastern Land Office |
| Brian Sugden | Plum Creek |
| Chris Town | Headwaters RC&D |
| William Wall | Sustainability, Inc. |
| Mark Vander Meer | National Network Forest Practitioners |
| | |

# Appendix H

Respectfully submitted to the Montana Environmental Quality Council, pursuant to House Joint Resolution No. 1, introduced by Representative French, and passed by Montana's 2009 legislature.

Montana's Woody Biomass Working Group represents a broad spectrum of interests, including: environmental organizations, academicians and research professionals, state and federal resource management specialists, private forest landowners, economic development organizations, tribal forestry, wood products manufacturers, and forest practitioners. A list of participating members is attached.

The Montana Woody Biomass Working Group respectfully submits the following for consideration by Montana's Environmental Quality Council:

1. We collectively support the development of woody biomass energy in Montana under the following conditions:
    a. Biomass energy plants should be developed at scales that reflect the sustainable resource base within a reasonable haul distance from each plant.
    b. Removal of biomass for energy is a product of sound and sustainable forest management that applies Montana's Forestry Best Management Practices (BMPs) and other voluntary forestry practices guidance issued by the state of Montana, including *Voluntary Wildlife Guidelines for Streamside Management Zones*, published by DNRC in 1995. BMPs evolve as new scientific information and new forest practices emerge. Additional tools may be developed to assist forest management decision-making with respect to potential differential effects of biomass harvest versus commercial timber harvest.
    c. Efficiency of energy recovery is an important consideration in energy development. Technologies such as combined heat and power, which make valuable use of more than one output from biomass, typically improve energy recovery substantially. Plants sited at lumber mills often have additional advantages, including readily available feedstock from wood processing waste, reduced cost and transportation of feedstock, reduced overall fuel risk, an on-site full time industrial-scale heat load, and a fully developed utility infrastructure.
2. We agree that woody biomass energy development that follows these principles is a locally produced, renewable and firm energy source.
3. We agree that the biggest barriers to developing woody biomass energy in Montana are social and economic. One immediate challenge is the relatively high cost of producing electricity with

biomass, in comparison to our existing sources of electricity. We also agree that the citizens and the state of Montana will retain and acquire many secondary benefits from sustainable woody biomass energy development that have value over and above the factors that are typically considered in rate-setting. These additional benefits justify the enactment of incentives for sustainable biomass energy development by policy-makers. These benefits include (but are not limited to):

a. Diversified revenue for forest products manufacturers, loggers and forest restoration practitioners that will help stabilize the industry, maintain jobs, and retain the local skills, equipment, and capacity needed to cost-effectively manage forest conditions.
b. Maintaining revenue to the state of Montana associated with jobs, taxes, and economic activity in the forest products industry.
c. Reduced cost of forest management and retention of working forests.
d. Reduced risk of escape and emissions from slash burning.
e. Capturing energy that would otherwise be wasted.
f. Reduced greenhouse gas emissions by offsetting fossil fuel burning with renewable biomass, while recovering energy from biomass disposal.

4. We suggest the following incentives for your consideration:
    a. Reduce the up-front capital cost and/or operating cost of biomass energy development through:
        i. Zero or low interest state loans,
        ii. Grants,
        iii. Tax incentives that reduce the cost of biomass energy plant operation,
        iv. Reduce the risk and improve access to low cost capital by requiring utilities to enter long term power purchase agreements with biomass energy producers, and/or
        v. Reduce the risk and improve access to low cost capital by encouraging fiber supply opportunities through consistent agency programs.
        vi. Provide production tax credit parity.
        vii. Tie any incentives to installed capacity thresholds to limit their overall cost and ensure that the growth of biomass energy development remains sustainable.

b. Increase the effectiveness of Montana's Renewable Portfolio Standard by:
    i. Requiring a specified portion of that standard to be met by base load/firming resources that are selected through a competitive process, such as a biomass-only Request For Proposals,
    ii. Provide an equivalent "green tag" value for the thermal energy portion of combined heat & power projects, and/or
    iii. Provide credit in renewable contracts for firm power, local reliability, and locational benefits (i.e., benefits associated with having smaller, dispersed plants where the transmission system is weak, unreliable, or has voltage problems).

c. Provide access to outside markets where Montana biomass power can better compete, by:
    i. Increasing transmission capacity with reasonable wheeling rates so Montana's green power can be sold to west-coast markets. Locations of new transmission capacity should conform to current land use designations and should avoid adverse impacts to exceptional natural values.

d. Continue support and promotion of smaller-scale thermal and power generation with woody biomass for residences, public buildings, and district systems.

5. We believe the benefits to the state outlined in item 3, above, will result in economic activity and income to the state that will more than offset the costs of well structured incentives for sustainable biomass energy development.

6. We suggest that the EQC consult with forest practitioners regarding possible approaches to making biomass removal a more attractive method of slash disposal than open burning, where removal is feasible and markets exist.

**Montana Woody Biomass Working Group Participants**

| | |
|---|---|
| David Atkins | USFS, Northern & Intermountain Regions, State & Private Forestry |
| Rich Lane | Missoula Area Economic Development Corporation |
| Craig Rawlings | Montana Community Development Corporation |
| Jason Todhunter | Montana Logging Association |
| Robert Ethridge | MT DNRC Forestry Assistance Bureau |
| Brian Spangler | MT DEQ Energy and Pollution Prevention Bureau |
| Howard Haines | MT DEQ Energy and Pollution Prevention Bureau |
| Julie Kies | MT DNRC Biomass Utilization Program |
| Julia Altemus | MT DNRC Forestry Division – Forest Policy |
| Todd Morgan | UM Bureau of Business and Economic Research |
| Joe Kerkvliet | The Wilderness Society, Northern Rockies Regional Office |
| Martin Twer | MSU Extension Forestry |
| Shawn Thomas | MT DNRC Trust Land Management |
| Angela Farr | MT DNRC Biomass Utilization Program & USFS, Northern & Intermountain Regions |
| Roger Ziesak | MT DNRC Forestry Assistance, Forest Practices |
| Len Broberg | UM Environmental Studies Program Director |
| Kevin Furey | MT DOC Energy Conservation and Development Division |
| John Thompson | Bureau of Land Management |
| Jim Durgalo | Confederated Salish and Kootenai Tribal Forestry |
| Chuck Roady | Montana Wood Products Association |
| Ellen Simpson | Montana Wood Products Association |
| Peter Kolb | UM College of Forestry and Conservation and MSU Extension Forestry |
| Elizabeth Dodson | UM College of Forestry and Conservation |
| Jeff Schmalenberg | DNRC Trust Land Management – Soils Scientist |

# Woody Biomass Energy
## Federal Issues & Legislation

Environmental Quality Council
September 10-11, 2009

Julia Altemus
Forest Policy

Angela Farr
Biomass Utilization

# Two Interest Areas

- Whether and how forest management & or waste is considered in climate change policy
  - Renewable Energy & Fuels Definitions
- Federal incentives & their impacts
  - Biomass Crop Assistance Program
  - Thermal energy standard
  - On-site electrical production
  - PTC parity

# Federal Forest Policy and State Opportunities

## Renewable Energy Standard (RES)

- S 536 Senator Wyden to amend the Clean Air Act to modify the definition of the term ‘renewable biomass’;
- S 523 Senator Tester to amend the Energy Policy Act of 2005 to establish pilot project offices to improve federal permit coordination for renewable energy;
- S 636 Senator Tester to amend the Clean Air Act to conform the definition of renewable biomass to the definition given the term in the 2002 Farm Bill;
- S 1462 Senator Bingaman ‘American Clean Energy Leadership Act of 2009’;
- HR 1111 Congressman Rehberg to promote as a renewable energy source the use of biomass removed from forest lands in connection with hazardous fuel reduction projects on certain federal lands;
- HR 1190 Congressman Herseth-Sandlin to promote the use of certain materials harvested from public lands in the production of renewable fuel; and
- HR 2454 Waxman-Markey ‘American Clean Energy & Security Act of 2009’

# Biomass Crop Assistance Program

- 2008 Farm Bill – FSA/CCC
  - Support the establishment and production of certain crops for conversion to bio-energy in project areas
  - Assist with collection, harvest, storage, and transportation of eligible material for use in a biomass conversion facility

- Draft EIS – **comment due Sept 24th**

# Biomass Crop Assistance Program

- Cash incentives via CCC for biomass collection, harvest, storage, and transportation
- $1 per $1 up to $45/dry ton for up to 2 years
- Qualified Conversion Facilities – NY, CA, MO, FL, AL, WI

FSA BIOMASS CROP ASSISTANCE PROGRAM

# Biomass Crop Assistance Program

- Includes mill residues used for heat, energy, biofuels.
- Skews values causing concern for current residue users.
- Appears to allow a facility to be both a supplier and a qualified conversion facility.
- Likely not to result in long term increases in biomass utilization or renewable energy production.

# Thermal Energy Efficiency Act 2009

- S. 1621 introduced by Sen. Sanders and Merkley
- Would establish competitive grant program
- 75% for construction-15% engineering/feasibility
- Split between industrial/commercial & public projects
- District heating systems, CHP or recoverable waste energy projects
- Funded via emission allowances under cap & trade

# Appropriations

- House and Senate drafts include funding for Community Wood to Energy title in the 2008 Farm Bill.
- Modeled after “Fuels for Schools” 6-state initiative.
- Funding would support state level programs similar to DNRC’s.

# On-site Electrical Production

- H.R. 622 (Ways & Means)
- S. 870 (Finance)

- Amend 1986 IRS code to expand the tax credit for renewable energy production to include electricity produced from biomass for on-site use

# Producer Tax Credit Parity

- Biomass credit is about half wind & solar
- Pulp & paper has resisted change
- Currently moot due to 30% grant in lieu
- Would mean 1.5 cent per kwh price reduction for the same return
- Sen. Wyden proposal

# Thank You

# Federal Forest Policy and State Opportunities

## Climate Change & Adaptation

HR 2454 Waxman-Markey Subtitle E Adapting to Climate Change

- EPA distribute allowances to States and Tribes based on (1) population and (2) the ratio of each State's per capita income;
- Allowance proceeds deposited into the State Energy and Environmental Development (SEED) Funds and used to support State Climate Adaptation Plans;
- Each State must gain federal approval of its Plan within 2 years of enactment;
- State reporting and independent evaluation is required within 1 year of receiving allowances; and
- Establishes a fund in the Natural Resources Climate Change Adaptation Account in the Treasury to allocate percentages to States for adaptation activities.

# Federal Forest Policy and State Opportunities

## Climate Change & Adaptation

'Climate Change Safeguards for Natural Resource Conservation' – Senate 9/2009

- State Natural Resource Adaptation Plans within 1 year to access funds with 5 year updates;
- Establishes a 'Natural Resource Climate Change Adaptation Fund';
- Of Allowances sold, 38.5% shall be provided to states to carry out plans;
- 5% to the Secretary of Interior cooperative grant programs, i.e., Landowner Incentive Programs;
- 1/6 from LWCF shall be competitively allocated to States for natural resource adaptation plans;
- 1/6 Deposits in LWCF allocated to the Secretary of Agriculture available to States carry out adaptation plan activities through land acquisition under section 7 of the Cooperative Forestry Assistance Act of 1978; and
- National Forest and Grassland Adaptation ~ 5% shall be allocated to the USFS to fund adaptation activities carried out on State and private forestlands under the Cooperative Forestry Assistance Act of 1978.

# Western Governors' Association

## Forest Health Advisory Committee – Climate Change and Adaptation

- Identify current assessments;
- Develop mitigation strategies;
- Communicate and coordinate management organizations and efforts;
- Identify states with established climate change programs and coordinators;
- Assess current strategic planning for climate change/adaptation; and
- Overall objective "Trees and Forests are effectively included in climate change/ adaptation policy in our nations".

## Climate Change and Adaptation Working Group

- Determines the appropriate uses of climate adaptation modeling in informing natural resource and economic infrastructure planning and policies;
- Fills existing gaps in climate adaptation efforts within WGA;
- Reviews current and future climate legislation to assess the impact to state and their efforts to adapt to a changing climate;
- Reviews the current status and utility of climate adaptation modeling across forests, water, air and wildlife;

## Biomass Utilization

- Develop informational resource site;
- Asses number and where there are active state level efforts; and
- Provide regional coordination and tools for communication

# Federal Forest Policy and State Opportunities

## Western Climate Initiative

- Task 1 – Design Criteria ~ Essential Elements
  - Definition of an Offset
  - Real
  - Additional
  - Permanent
  - Verifiable

- Task 3 – Offsets
  - Forestry Protocols
  - Agriculture Protocols
  - Waste Wood Protocols

SENATE BILL NO. 146

INTRODUCED BY R. LAIBLE

BY REQUEST OF THE FIRE SUPPRESSION COMMITTEE

A BILL FOR AN ACT ENTITLED: "AN ACT PROVIDING A CREDIT AGAINST INDIVIDUAL INCOME OR CORPORATE INCOME TAXES FOR BIOMASS PRODUCTION OR BIOMASS COLLECTION; AND PROVIDING AN IMMEDIATE EFFECTIVE DATE AND A RETROACTIVE APPLICABILITY DATE."

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF MONTANA:

NEW SECTION. **Section 1. Biomass production or collection -- definitions.** (1) (a) Subject to subsection (1)(c), an agricultural producer or biomass collector is allowed a credit against the taxes that would otherwise be due under Title 15, chapter 30 or 31, for the production or collection of biomass that is used in Montana as biofuel or to produce biofuel.

(b) A credit under this section may be claimed in the tax year in which the agricultural producer or biomass collector transfers biomass to a biofuel producer.

(c) A tax credit is not allowed for grain corn, but a tax credit is allowed for other corn material.

(2) The amount of the credit must be calculated as follows:

(a) determine the quantity of biomass transferred to a biofuel producer during the tax year;

(b) categorize the biomass into appropriate categories; and

(c) multiply the quantity of biomass in a particular category by the appropriate credit rate for that category, expressed in dollars and cents, that is prescribed in subsection (7).

(3) The amount of the credit claimed under this section for any tax year may not exceed the tax liability of the taxpayer.

(4) (a) A biofuel producer shall provide a written receipt to an agricultural producer or biomass collector at the time biomass is transferred from the agricultural producer or biomass collector to the biofuel producer. The receipt must state the quantity and type of biomass being transferred and that the biomass is to be used to produce biofuel.

(b) Each agricultural producer and biomass collector shall maintain the receipts described in subsection (4)(a) in their records for a period of at least 5 years after the tax year in which the credit is claimed or for a longer period of time prescribed by the department.

(5) The credit must be claimed on a form prescribed by the department that contains the information required by the department.

(6) Any tax credit otherwise allowable under this section that is not used by the taxpayer in a particular tax year may be carried forward and offset against the taxpayer's tax liability for up to 4 succeeding tax years but may not be carried forward beyond the fourth tax year.

(7) The credit rates for biomass are:

(a) for oil seed crops, $0.05 per pound;

(b) for grain crops, including but not limited to wheat, barley, and triticale, $0.90 per bushel;

(c) for virgin oil or alcohol delivered for production in Montana from Montana-based feedstock, $0.10 per gallon;

(d) for used cooking oil or waste grease, $0.10 per gallon;

(e) for wastewater biosolids, $10 per wet ton;

(f) for woody biomass collected from nursery, orchard, agricultural, forest, or rangeland property in Montana, including but not limited to pruning, thinning, plantation rotations, log landing, or slash resulting from harvest or forest health stewardship, $10 per green ton;

(g) for grass, wheat, straw, or other vegetative biomass from agricultural crops, $10 per green ton;

(h) for yard debris and municipally generated food waste, $5 per wet ton; and

(i) for animal manure or rendering offal, $5 per wet ton.

(8) As used in this section and [section 2], the following definitions apply:

(a) "Agricultural producer" means a person that produces biomass that is used in Montana as biofuel or to produce biofuel.

(b) "Biofuel" means liquid, gaseous, or solid fuels derived from biomass.

(c) (i) "Biomass" means organic matter that is available on a renewable or recurring basis and that is derived from:

(A) forest or rangeland woody debris from harvesting or thinning conducted to improve forest or rangeland ecological health and reduce wildfire risk;

(B) agricultural residues;

(C) offal and tallow from animal rendering;

(D) food wastes;

(E) yard or wood debris;

(F) wastewater solids; or

(G) crops grown solely to be used for energy.

(ii) The term does not mean wood that has been treated with creosote, pentachlorophenol, inorganic arsenic, or other inorganic chemical compounds.

(d) "Biomass collector" means a person that collects biomass to be used in Montana as biofuel or to produce biofuel.

NEW SECTION. **Section 2. Transfer of biomass credit.** (1) Subject to subsection (3), a person that has obtained a tax credit under [section 1] may transfer the credit for consideration to a taxpayer subject to tax under Title 15, chapter 30 or 31.

(2) To transfer the tax credit, the taxpayer earning the credit and the taxpayer that will claim the credit shall jointly file a notice of tax credit transfer with the department. The notice must be given on a form prescribed by the department that contains all of the following:

(a) the name, address, and taxpayer identification number of the transferor and the transferee;

(b) the amount of the tax credit; and

(c) any other information required by the department.

(3) A tax credit may not be transferred under this section:

(a) from an agricultural producer to a biomass collector claiming a credit for collecting the biomass; or

(b) from a biomass collector to an agricultural producer claiming a credit for producing the biomass.

NEW SECTION. **Section 3. Codification instruction.** [Sections 1 and 2] are intended to be codified as an integral part of Title 15, chapter 32, and the provisions of Title 15, chapter 32, apply to [sections 1 and 2].

NEW SECTION. **Section 4. Effective date.** [This act] is effective on passage and approval.

NEW SECTION. **Section 5. Retroactive applicability.** [This act] applies retroactively, within the meaning of 1-2-109, to tax years beginning after December 31, 2008.

- END -

# Fiscal Note 2011 Biennium

GOVERNOR'S OFFICE OF BUDGET AND PROGRAM PLANNING

| | | | |
|---|---|---|---|
| **Bill #** | SB0146 | **Title:** | Biomass tax credit |
| **Primary Sponsor:** | Laible, Rick | **Status:** | As Introduced |

- ☐ Significant Local Gov Impact
- ☐ Needs to be included in HB 2
- ☑ Technical Concerns
- ☐ Included in the Executive Budget
- ☐ Significant Long-Term Impacts
- ☐ Dedicated Revenue Form Attached

## FISCAL SUMMARY

| | FY 2010 Difference | FY 2011 Difference | FY 2012 Difference | FY 2013 Difference |
|---|---|---|---|---|
| **Expenditures:** | | | | |
| General Fund | $45,117 | $36,617 | $37,340 | $37,340 |
| **Revenue:** | | | | |
| General Fund | ($128,225) | ($128,225) | ($320,563) | ($320,563) |
| **Net Impact-General Fund Balance** | ($173,342) | ($164,842) | ($357,903) | ($357,903) |

**Description of fiscal impact:**
This bill would provide a credit against individual income tax or corporate license tax for biomass sold to a Montana biofuel producer. Credits would be about $0.1 million in FY 2010 and FY 2011 and $0.3 million in FY 2012 and FY 2013. If additional facilities are built to make biofuels from biomass, credits could eventually be much higher.

## FISCAL ANALYSIS

**Assumptions:**

1. This bill would provide a credit against individual income tax or corporate license tax to a person who produces or collects biomass and transfers the biomass to a Montana biofuel producer. The credit amount is
   a. $0.05 per pound for oilseed,
   b. $0.90 per bushel for grains other than corn,
   c. $0.10 per gallon for virgin oil or alcohol from Montana-based feedstock,
   d. $0.10 per gallon for used cooking oil,
   e. $10 per wet ton for wastewater biosolids,
   f. $10 per green ton for woody biomass collected in Montana,
   g. $10 per green ton for crop residues,

   h. $5 per ton for yard debris and food waste, and
   i. $5 per ton for animal manure or rendering offal.

2. New biomass use for energy will be limited by the facilities available to use it; therefore, credit use through FY 2013 will be estimated as a fraction of potential credits on existing, quantifiable biomass use for energy. Woody biomass is by far the largest contributor to biomass energy usage, as well as being one of the few quantifiable sources of energy. For the first two years, total credits are assumed to be equivalent to credits for 10% of woody biomass currently used in electricity generation. For the third and fourth years, total credits are increased to the equivalent of credits for 25% of woody biomass currently used in electricity generation.
3. In 2007, there were 88,086,000 kilowatt-hours (kWh) of electricity generated in Montana using fuels derived from wood (Energy Information Administration, U.S. Department of Energy, *Renewable Energy Annual*). The heat input required per kilowatt-hour of electricity generated for a typical wood waste fired cogeneration plant is 14,500 Btu/kWh (Northwest Power and Conservation Council, *5th Northwest Electric Power and Conservation Plan, Appendix J*). The average heat energy released by burning a ton of wood waste is 9,961,000 Btu (Energy Information Administration, U.S. Department of Energy, *Renewable Energy Trends in Consumption and Electricity 2006*). Based on this information, there were 128,225 tons of wood waste used to produce electricity in Montana in 2007 (88,086,000 kWh × 14,500 Btu/kWh ÷ 9,961,000Btu/ton).
4. The credit would available beginning tax year 2009. Credits for 2009 and 2010 will be $128,225 (10% × $10/ton × 128,225 tons). Credits for 2011 and 2012 will be $320,563 (25% × $10/ton × 128,225 tons.)
5. Credits would be claimed on income tax returns filed in the fiscal year following each tax year. The first credits would be claimed in FY 2010.
6. The credit a taxpayer may claim for a tax year is limited to their tax liability for that year. However, a credit may be carried forward for up to four years or sold to another party with tax liability. This fiscal note assumes that any credits that would have to be carried forward will be sold and claimed in the current fiscal year.
7. This credit would require a new line on both the individual and corporation tax returns and additional instructions in the tax return booklets. A new credit form and a form for credit transfers would also be needed. The Department of Revenue would incur one time costs of $4,000 for developing forms in FY 2010.
8. Although there is a limited number of bioenergy facilities, there may be a large number of taxpayers who take the credit for selling biomass to these facilities. The Department of Revenue would need an additional 0.5FTE tax examiner to process and audit credit claims. Annual salary would be $18,298, and benefits would be $10,623. Operating costs would be $7,696 per year, and one-time costs to set up a new employee would be $4,900.

| | FY 2010 Difference | FY 2011 Difference | FY 2012 Difference | FY 2013 Difference |
|---|---|---|---|---|
| **Fiscal Impact:** | | | | |
| **FTE** | 0.50 | 0.50 | 0.50 | 0.50 |
| **Expenditures:** | | | | |
| Personal Services | $28,921 | $28,921 | $29,644 | $29,644 |
| Operating Expenses | $11,296 | $7,696 | $7,696 | $7,696 |
| **TOTAL Expenditures** | $45,117 | $36,617 | $37,340 | $37,340 |
| **Funding of Expenditures:** | | | | |
| General Fund (01) | $45,117 | $36,617 | $37,340 | $37,340 |
| **Revenues:** | | | | |
| General Fund (01) | ($128,225) | ($128,225) | ($320,563) | ($320,563) |
| **Net Impact to Fund Balance (Revenue minus Funding of Expenditures):** | | | | |
| General Fund (01) | ($173,342) | ($164,842) | ($357,903) | ($357,903) |

**Long-Term Impacts:**

1. If additional biofuel facilities are built in the state, credits could increase significantly in later years. For example, there are on the order of 40 million dry tons of biomass in small diameter trees on accessible land within 50 miles of a city in western Montana. If 5% of this amount were harvested for use in biofuels each year, the resulting credits would be $20 million per year.

**Technical Notes:**

1. This bill provides a tax credit for the sale of a list of commodities for use in biofuel production, with the credit given as a dollar amount per ton, wet ton, or green ton. It is not clear whether these weights, particularly "wet ton" and "green ton," are intended to mean weight adjusted to standard moisture content or weight regardless of moisture content. The bill should either define these terms or give the Department of Revenue authority to define them in rule.
2. Subsection 1(8)(a) defines "Agricultural producer" to mean "a person that produces biomass that is used in Montana as biofuel or to produce biofuel." This definition is significantly different from the ordinary meaning of the term. It includes persons who would not ordinarily be considered "agricultural producers" and excludes most who are. To avoid confusion, it would be better to use another term, such as "biomass producer."
3. Subsection 1(8)(d) defines "biomass collector." It is not clear from this definition whether the term is meant to cover intermediaries, who collect and resell biomass from biomass producers, or persons who collect biomass they do not produce, such as slash from others' logging operations. If the term does not include intermediaries, it appears that no credit could be claimed in cases where the producer or collector does not sell directly to the biofuel producer.
4. Given the ambiguity in the definition of "biomass collector," the intent of Subsection 2(3) is unclear. If "biomass collector" means an intermediary who buys and sells biomass, Subsection 2(3) appears to prevent the transfer of credits between a biomass producer and an intermediary. If "biomass collector" means a person who collects freely available biomass, Subsection 2(3) appears to prevent the transfer of credits between parties who are able to claim credits directly for their own actions.

5. Subsection 1(2) specifies that the action a taxpayer must take to be eligible for the credit is transferring biomass to a biofuel producer. It appears that a biofuel producer would not be able to take the credit for producing or collecting biomass itself. Also, the term "biofuel producer" is not defined in the bill or in Title 15, Chapter 32, where Section 1 would be codified.
6. Subsection 1(8)(c)(A) defines biomass as including "forest or rangeland woody debris from harvesting or thinning conducted to improve forest or rangeland ecological health and reduce wildfire risk." It is not clear whether the clause "conducted to improve forest or rangeland ecological health and reduce wildfire risk" is intended to modify the phrase "debris from harvesting or thinning" or to modify the single word "thinning." If the first reading is correct, "biomass" would not include slash from commercial logging operations. If the second reading is correct, "biomass" would include all logging slash. This fiscal note assumes that the first reading captures the intent of the bill. If the second reading is correct, the amount of credits is likely to be higher.
7. There appears to be an extra comma between "wheat" and "straw" in Subsection 7(g). Subsection 7(b) provides a credit amount for grain crops.
8. Subsection 7(h) provides a credit for "municipally generated food waste." This term is not defined, and it is not clear whether the intent is to provide a credit for food waste from municipal food service facilities or for food waste collected by municipal solid waste utilities.
9. Subsection 1(1) specifies that the credit is for biomass used in Montana as biofuel or to produce biofuel. Subsection 1(7) limits the credit for oil or alcohol feedstocks and woody biomass to biomass produced in Montana. The bill does not require a Montana source for other types of biomass. This fiscal note assumes that the intent is to provide a credit when these other types of biomass are used in Montana regardless of their source.
10. It appears that the credit could be claimed under Subsections 1(7)(a) or (b) for supplying oilseed or grain to be used in oil or alcohol production and that the credit could then be claimed under Subsection 1(7)(c) for supplying that oil or alcohol for use in biofuel production. If the intent is not to provide this double credit, it needs to be made explicit.
11. This bill does not make any provision for pass-through entities to claim the credit for their owners.
12. Unlike most credits, this bill does not provide a maximum credit per taxpayer.

| *Sponsor's Initials* | *Date* | *Budget Director's Initials* | *Date* |
|---|---|---|---|

# Appendix K

**DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION**

BRIAN SCHWEITZER, GOVERNOR

1625 ELEVENTH AVENUE

STATE OF MONTANA

DIRECTOR'S OFFICE (406) 444-2074
FAX: (406) 444-2684

PO BOX201601
HELENA, MONTANA 59620-1601

# Memo

To: Sonja Nowakowski

From: Alice Stanley, Chief Resource Development Bureau; DNRC

Date: October 13, 2009

RE: Use of the Renewable Resource Grant Program to Support Bio Fuels Projects

Bio Fuels projects are eligible for funding by the Renewable Resource Grant and Loan Program (RRGL). This program may fund any government agency project that conserves, improves management, preserves, or develops a renewable resource. While the RRGL program has not yet received a grant application for a bio fuels project, we are currently working with the DNRC Forestry division and a school district to develop grant applications for the 2010 funding cycle.

This memo provides a description of the RRGL program, a list of the types government entities that have successfully applied for grants, and a discussion of likely impediments to future applicants for bio fuels projects grants.

<u>Background</u>

The RRGL program is a combination of two resource management programs: the former Renewable Resource Development program, established by the Legislature in 1975 to promote the development of Montana's renewable resources; and the former Water Development program established in 1981 to promote and advance the beneficial use of water. When these two programs were combined in 1993 (Title 85, part 6, MCA), the purpose of the grant program was expanded to fund projects that "conserve, manage, develop, or preserve" the state's renewable resources.

Projects affecting water, land, vegetation, fish, wildlife, habitat, and other renewable resources have been funded by this grant program. The majority of projects funded under this program are water resource projects, but forestry, soil conservation, renewable energy, and recreation have also received funding. Eligible government entities include: school districts, universities, cities and towns, counties, irrigation districts, conservation districts, water districts, and state agencies.

Program Description

RRGL grants and loans must be approved by the Montana State Legislature. The application deadline is May 15 on every even-numbered year before a legislative session. DNRC evaluates and scores applications based on statutory requirements and current legislative initiatives. Applications are scored because typically funds are available to fund from 50% to 75% of the projects. Projects are ranked based on scores. The Governor presents these ranking recommendations to the legislature in Volume 6 of the Executive Budget. The projects and their ranking are considered by the Joint Long Range Planning Committee, House Appropriations Committee and the Senate Finance and Claims Committee. The Legislature and the Governor must approve funding and the ranked order of the projects in House Bill 6 before they can be funded. Grants are available for approved projects starting July 1 following the legislative session.

The RRGL program offers the following grants and low interest loans:

Project grants: up to $100,000, must be approved by the legislature, no match is required.

Planning grants: these are noncompetitive, first-come, first-served until funding is depleted. No match is required. Three types of planning grants are offered: $5,000 for grant writing assistance or capital improvements plans, up to $10,000 for alternatives assessment or feasibility studies, and up to $20,000 for an preliminary engineering report. We distributed about $1 million in planning grants between May and September this year.

Low Interest Loans: Interest and term is set by the legislature usually based on DNRC recommendation. Interest is usually the cost of the bond issued to secure the loan. Loans can be for any amount based on the ability to pay.

Program Revenue

The RRGL program is funded by resource extraction taxes. In this way, funds generated by the profits from nonrenewable mineral resources are used to benefit Montana's renewable resources. The revenue streams for this grant program are: interest earnings from the Resource Indemnity Trust, and portions of Resource Indemnity and Groundwater Assessment Tax, the Oil and Gas Assessment Tax, and the Metalliferous Mines Tax. These revenue sources are volatile right now, however, based on past experience, we expect about $5 million to be available for Renewable Resource grants in 2011. Because all projects must have a work plan with a feasible scope, schedule and budget to be eligible for consideration, the 2009 Legislature supplemented the RRGL budget with the use of HB645 funding and all projects were funded.

Impediments to Potential Project Sponsors

Although the following impediments apply to all project types, these in particular appear to be the most likely deterrents for bio fuels projects based on my staff's discussions with potential applicants for bio fuels funding.

1. **The span of time between an applicant's project idea and available funding is too long**. Many project sponsors need their funding within six months to a year of the time they conceive of a project. Because all project grants must be approved by the Legislature, grants are approved once every two years.
2. **The project grant application is too complex to be easily completed**. The complexity of the grant application is a function of the need to objectively score each project combined with the challenge of comparing and ranking a broad array of project types. If the RRGL program were guaranteed 100% funding, the application would be a simple statement of eligibility qualifications. DNRC recently initiated a planning grant program that distributes funds based only on eligibility. This has helped many communities and other entities better define their projects and submit good applications.
3. **Nongovernment entities such as private foresters and wood processing plants are not eligible** for an RRGL grant or loan. This is pretty easy to overcome. Often a nongovernment entity, such as Trout Unlimited or an irrigation association has successfully teamed with a government entity to seek a grant from the RRGL program.
4. **The funding cap of $100,000 per grant is inadequate for some projects.** Most of the projects funded by the RRGL program receive grants and/or loans from multiple sources. A funding package containing 5 or 6 sources is not unusual for these projects.

# Montana Forest Biomass Supply

**Todd A. Morgan, CF**

**January 7, 2010**
**Environmental Quality Council**
**Helena, MT**

## Montana's Timber Resource Non-reserved Timberlands 2003-2007

| | | |
|---|---|---|
| Growing stock volume | | 36,733 MMCF |
| Annual (gross) growth | | 862 |
| Annual mortality | | 456 |
| Annual harvest | (2004) | 198 |
| | (2007) | 147 |
| | (2009) | 82 |

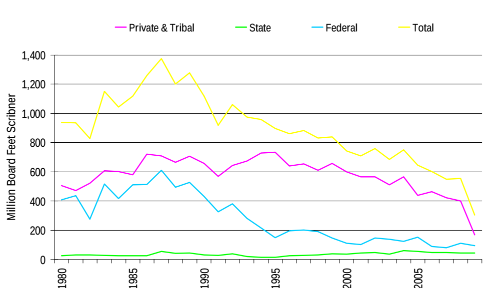
## Montana's Timber Harvest & Forest Products Industry

## Montana's Timber Resource Non-reserved Timberlands 2003-2007

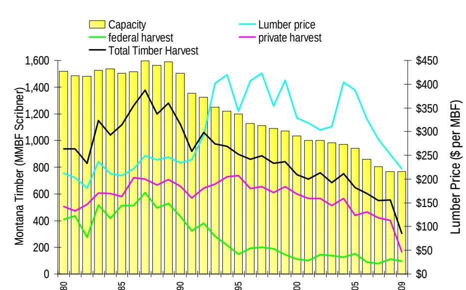
| | | Public | Private |
|---|---|---|---|
| 2007 | Net Growth (MMCF/yr) | 268 | 137 |
| | Removals (MMCF) | 35 | 112 |
| | Ratio | 7.6 : 1 | 1.2 : 1 |

Sources: Miles & Hansen, Fri, Aug 1, 2008: Forest Inventory EVALIDator web-application version 1.0 http://199.128.173.26/evlidator/tmattribute.jsp

## Montana Annual Timber Harvest 1980-2009

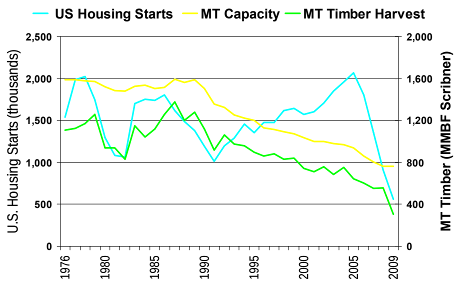



## Montana Timber-Processing Capacity & U.S. Lumber Prices, 1980-2008



## US Housing & MT Wood, 1976-2009

Sources: U.S. Census Bureau; BBER




## Montana Forest-based Woody Biomass

- **Logging residue: < 0.6 MDT per year**
  - **Amount produced is declining**
- **Mill residue: < 1.5 MDT per year**
  - **More than 99% already used**
  - **Amount produced is declining**

## Forest Biomass Terminology

- **Timberland**
  - **Live tree woody biomass**
  - **Standing dead tree woody biomass**
- **Logging residue**
- **Mill residue**

## Montana Forest-based Woody Biomass

- **Timberland: 20 million acres**
  - **61% is national forests**
  - **Live trees: 725 MDT**
    - **74% in national forests**
  - **Dead trees: 136 MDT**
    - **85% in national forests**

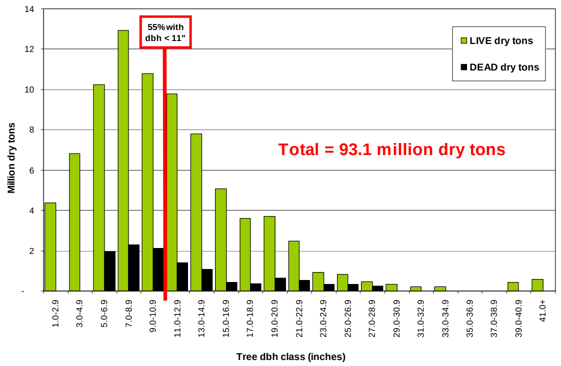
## Montana Forest-based Woody Biomass

- **Current use: ~2.5 million dry tons (MDT) per year**
  - **More than 50% used by one facility**
  - **Less than 50% comes from in-state mill residue**
  - **Biomass & pulpwood < 10% of harvest volume**

## “Filtered” forest inventory

- **Stands within ½ mile of a road**
- **Stand ages of 0 to 100 years**
- **Slope of 0 to 40%**
- **Tree dbh of 5.0 to 10.9 inches**

Figure 1: Live and standing dead tree above-ground woody biomass on Montana non-reserved timberland, 0.5 mile or less from a road, on slope less than 40%, in stand ages 0-100 years.




## Biomass supply is NOT an issue.

**Multi-decade supply potentially available.**

**Availability is an issue!**

- **Land ownership & accessibility**
- **National forests are vitally important**

**Sawmills need sizeable residue users.**

**Landowners need small tree & slash users.**

## Woody Biomass Opportunity

**"Potentially available"**

- **3.6 million acres**
  - **18% of total timberland**
  - **less than 1/3 of currently roaded**
- **40.3 MDT in live & dead trees**
  - **70% in national forests**
  - **5% of total biomass on timberland**

BUREAU OF BUSINESS AND ECONOMIC RESEARCH

## Contact Info

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**Email:**

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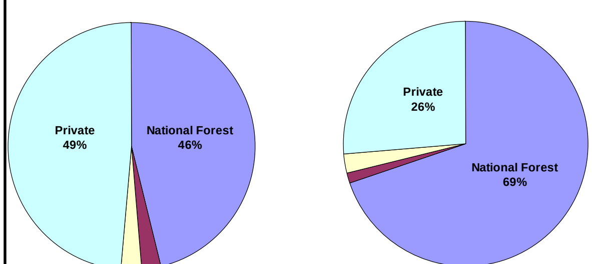
**Internet:**

**www.BBER.umt.edu**

## "Potentially Available" Land and Live & Standing Dead Tree Woody Biomass in Montana




**3.6 million acres** **40.3 million dry tons**

## Montana Agricultural Biomass Residual Overview



Department of Environmental Quality
Renewable Energy and Clean Air Program

**January 7, 2010**

Brian Spangler
and Howard Haines

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**DEQ Energy and Pollution Prevention Bureau has had a long relationship with Department of Energy (DOE) Biomass and Bioenergy program. DEQ has worked on biomass and bioenergy development in the state in cooperation with DOE since 1982.**

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## OVERVIEW

- Agricultural Sources of Biomass
- Benefits of Ag Biomass
- Agricultural Residual
- Potential Agricultural Residual Locations
- Biomass Energy Applications
- Conversion Technologies
- Challenges
- Solutions

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## Sources of Agricultural Biomass

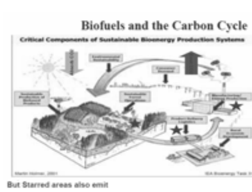
- Biomass energy or "bioenergy“ the energy from plants and plant-derived materials.
- Wood is the largest biomass energy resource
- Other agricultural sources of biomass include
  - food crops
  - grassy and woody plants
  - residues from agriculture or forestry
  - organic component of municipal/industrial wastes
  - Manure and landfill gas (60% methane, a natural gas).

---

## Benefits of Using Biomass

Ag Biomass use is favored in rural areas:

1. Use CO2 when they grow
2. Reduce all 3 GHG emissions when used ($CO_2$, $CH_3$, $N_20$)
3. Reduce transport energy (regional use)
4. Reduces “fossil” CO2 emissions
5. Only replacement for “transportation” liquid fuels

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## Benefits of Using Biomass

Supports U.S. agricultural and forest-product industries. Main biomass feedstocks are paper mill residue, lumber mill scrap, and municipal waste.

Current biomass fuels,
- Corn (for ethanol)
- Wheat and barley (ethanol)
- Soybeans and canola (for biodiesel)

Near Future
- Corn stover (the stalks & husks) and wheat straw

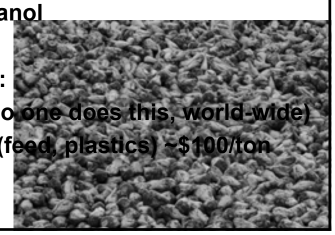
Long-term plans: growing dedicated energy crops on land that will not support intensive food crops

## Montana Agricultural Residuals

A. Grasses from CRP lands
B. Surplus grain straw and low quality hay
C. Sugar Beet Pulp
D. Sileage crops as rotation crop
E. Hybrid poplar/willow trees
F. Feedlots and Dairy (Biofuels)

## Montana Agricultural Residuals

**Sugar Beet Pulp**
**98,300 tons per year, Billings & Sidney**
**1.475 trillion Btu/y ~11.9 kW annual capacity**
**5 million gal/yr of ethanol**



**Not particularly likely:**
- **Technical issues (no one does this, world-wide)**
- **Competing market (feed, plastics) ~$100/ton**

## *Montana Agricultural Residual*

***Grasses planted onto CRP***

**Current Rule (USDA Conservation Reserve Program):**
**25% of 3.49 million acres ~**

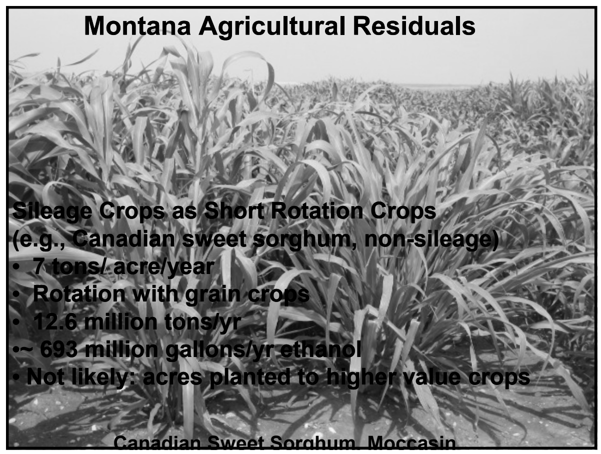
**872,500 acre/yr**
**1.09 million tons biomass/yr**
**16.35 trillion Btu/yr**
**60 million gal/yr of ethanol**

Switchgrass

**Harvest frequency increased 33.3% ~ 1.16 million acres**
**1.45 million tons biomass/yr**
**21.75 trillion Btu/yr (~796 kW annual capacity)**
**79.75 million gal/yr ethanol**

**50% harvest rate = 1.7 million acres**
**2.18 million tons biomass/yr**
**32.7 trillion Btu/yr, ~263.5 kW nominal annual capacity**
**120 million gallons/ year ethanol**

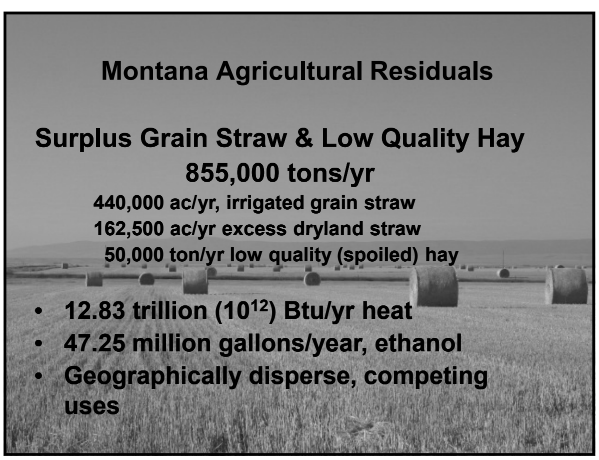
## Montana Agricultural Residuals



**Sileage Crops as Short Rotation Crops**
**(e.g., Canadian sweet sorghum, non-sileage)**
- **7 tons/ acre/year**
- **Rotation with grain crops**
- **12.6 million tons/yr**
- **~ 693 million gallons/yr ethanol**
- **Not likely: acres planted to higher value crops**

**Canadian Sweet Sorghum, Moccasin**

## Montana Agricultural Residuals

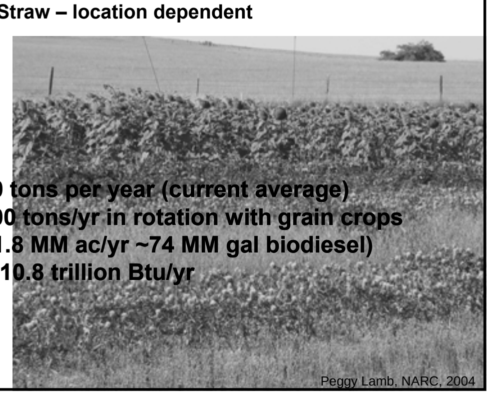


**Surplus Grain Straw & Low Quality Hay**
**855,000 tons/yr**
**440,000 ac/yr, irrigated grain straw**
**162,500 ac/yr excess dryland straw**
**50,000 ton/yr low quality (spoiled) hay**

- **12.83 trillion ($10^{12}$) Btu/yr heat**
- **47.25 million gallons/year, ethanol**
- **Geographically disperse, competing uses**

## Montana Agricultural Residuals

**Oilseed Straw – location dependent**



**•80,000 tons per year (current average)**
**•720,000 tons/yr in rotation with grain crops**
**(1.8 MM ac/yr ~74 MM gal biodiesel)**
**•1.2 to 10.8 trillion Btu/yr**

Peggy Lamb, NARC, 2004

## Montana Agricultural Residuals

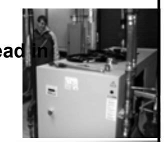
### Hybrid Poplar (willows)

- **Black Alder, hybrid poplars best suited to Montana** (DNRC Energy Div, WSU, P Moore, 1987)
- **1980s: 7-yr rotation**, Est 10-15 ton/yr avg growth
- ~ 70 to 105 tons per acre harvested, 10,000 ac/yr
- **State lands and near wastewater ponds/lagoons**
- **~700,000-1,050,000 ton/yr**
- **10.5 - 15.75 trillion Btu/yr**
- **39-58 million gal/yr ethanol**

## Animal Manure: Feedlots, Dairies Biofuels

**Biogas from anaerobic digestion of hog, chicken, dairy & feedlot manure**

- Huls Dairy, Corvallis, 400 cows
  50 kW, 350,000 Btu/hr
- Leaves "fertilizer" co-product
- Limited by net-metering
- Limits being lowered for herd size (50 head in MN)

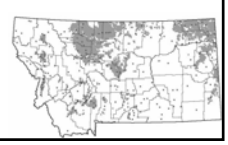



Stirling Engine, Helena MT

## Potential Montana Agricultural Residues: Locations

- **Montana has 2-3 major agricultural regions**
  - **Golden Triangle (45% of actively farmed Montana land)**
  - **Northeastern corner (29% of farmed land)**
  - **Area around Billings (shipping and processing)**
  - **Elevator & milling waste**

    (50 million gal/yr ethanol)

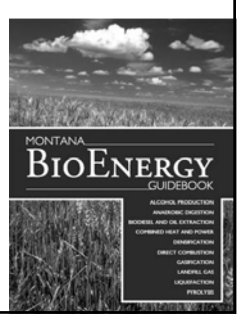


## Biomass Energy Applications

- Biofuels — Converting biomass into liquid fuels for transportation
- Biopower, Bioheat — Burning biomass directly, or converting it into gaseous or liquid fuels that burn more efficiently, to generate electricity
- Bioproducts — Converting biomass into chemicals for making plastics and other products that typically are made from petroleum

## Conversion Technologies

- Direct Combustion
- Gasification
- Pyrolysis
- Cellulosic Ethanol
- Biorefinery




## Direct Combustion

**Boilers and furnaces can be used for heat, steam and power.**

**Direct combustion creates hot gases to produce steam in a boiler - the most common use of biomass as in Fuels for Schools Projects.**

**Combined heat and power (CHP), also known as cogeneration, is the combined generation of thermal and mechanical energy, usually heat and electricity. CHP systems can have efficiencies over 80% fuel to useful energy.**

**e.g., Smurfit Stone, Hall's Wood Processing**

## Gasification

- Gasification: heating hydrocarbon material (biomass) in an oxygen-starved environment to produce synthesis gas, or water gas (CO+H2O).
- "Close coupled" gasifiers combust these gases cleanly with addition of air (Thompson Falls, Kalispell, Dillon Fuels for Schools gasifier & boiler).
- "Indirect" gasifier gases combined with a catalyst can produce liquid and gaseous fuels (like the North Dakota Coal Gasifier making methane)

## Pyrolysis

- Pyrolysis and gasification are related processes, heating hydrocarbons with limited oxygen.
- Pyrolysis, however, is generally a process that includes virtually no oxygen, hopefully to produce a cleaner burning fuel: they are commercial e.g., "Liquid Smoke" for barbeques
- Biochar is a porous charcoal-like substance remaining after pyrolysis. It can store carbon to improve soil fertility in non-alkaline soils

## Cellulosic Ethanol

Cellulose is a way plants and trees store food (sugar)

Cellulose + H2O ~ starch, Starch + H2O = sugar

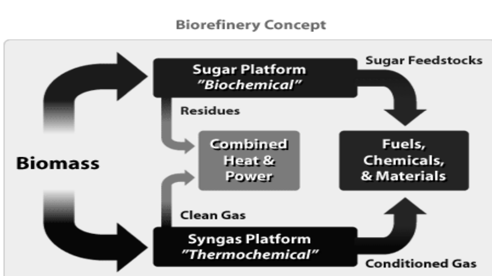
Wood and grasses use lignin to protect the cellulose lignin must be broken down to access the cellulose for ethanol.

3 methods (sometimes in combination)
- enzymes
- acids or
- heat and pressure

## Biorefinery

DOE vision is to develop technology for biorefineries that will convert biomass into a range of valuable fuels, chemicals, materials, and products - much like oil refineries and petrochemical plants do.

## Biorefinery




## Challenges

- Energy crops must compete with traditional crops. May not be as profitable
- Montana has a shortage of precipitation (relative to other areas) and limited growing season
- Biomass is bulky and geographically dispersed, long hauling distances
- Need research on cost effective collection systems

## Possible Solutions

- Smaller, geographically diverse production facilities with regional markets for co-products; Local & regional plants to reduce transportation and initial cost (EF Biofuels, Chester)
- Cost effective collection systems
- Educate the public on the benefits of biomass energy

**The End.**

**Thanks for Listening, Questions?**

Montana Department of Environmental Quality

## Biofuels Net Energy

| Fuel | Energy units in | To Produce units of energy out |
|---|---|---|
| Biodiesel | 1 | 4.56 |
| Biomass derived D2 | 1 | 15-60 |
| Ethanol (corn) | 1 | 1.67-2.12 |
| Ethanol, cellulosic | 1 | 4.0-7.0+ |
| Petroleum gasoline, diesel | 1 | 0.88 |

## Biodiesel Use (variable, depends on cost)

| State FY | MGY blend | Gal B-100 |
|---|---|---|
| 2004 | 0.345 | 70,000 |
| 2005 | 0.347 | 71,000 |
| 2006 | 0.348 | 71,149 |
| 2007 (thru Nov) | nya | 336,180** |
| 2008 | | 946,328 |
| 2009 (19,120 In State) | | 808,838 |

RFS – 1

•2022: 74 MGY (1.8 million acres/year)

## Ethanol Use

| State FY | MGY blend | MGY ethanol |
|---|---|---|
| 2004 | 17 | 2.4 |
| 2005 | 30 | 3.1 |
| 2006 | 30 | 3.0 |
| 2007 (thru Mar) | 12.6+export | 3.1 |
| 2008 (thru May) | 37.2+ lo Blend & export | |
| 2009 | 168.911 | 16.891 |

RFS-1 Ethanol Production Goals

•2022: 250 MGY starch, 50 MGY cellulosic

# biochar

**AN ELEGANT SOLUTION FOR COMPLEX PROBLEMS**

# biomass to biochar

**Zero-Waste and Carbon Negative…**

**Can it be done?**

## What is Biochar?

*"Biochar is a* ***fine-grained charcoal*** *high in organic carbon and largely* ***resistant to decomposition****. It is produced from pyrolysis of plant and waste feedstocks. As a* ***soil amendment****, biochar creates a recalcitrant soil carbon pool that is carbon-negative, serving as a* ***net withdrawal of atmospheric carbon dioxide*** *stored in highly recalcitrant soil carbon stocks. The* ***enhanced nutrient and moisture retention*** *capacity of biochar-amended soil not only reduces the total fertilizer requirements, but also the climate and environmental impact of croplands."*

*(International Biochar Initiative Scientific Advisory Committee)*

## Translation:

*Biochar is a fine-grained charcoal high in organic carbon and largely resistant to decomposition. It is produced from pyrolysis of plant and waste feedstocks…*

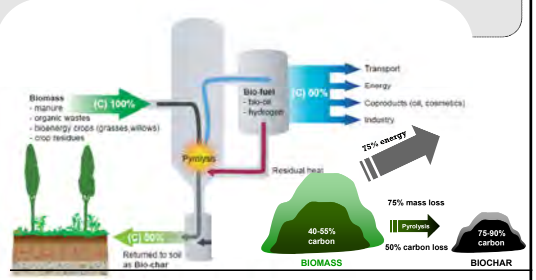
Charcoal made from plant material or waste in high-temperature ovens with limited oxygen.

## Translation:

*…As a soil amendment, biochar creates a recalcitrant soil carbon pool that is carbon-negative, serving as a net withdrawal of atmospheric carbon dioxide stored in highly recalcitrant soil carbon stocks…*

When put in soil, biochar sequesters carbon for 1000's of years. It's carbon-negative because it holds carbon from that would otherwise remain in the active carbon cycle.

## Biochar = carbon-rich residue of heating biomass without oxygen




Lehmann, 2007, *Frontiers in Ecology and the Environment* 7, 381-387

## Products of Pyrolysis

- Syngas
- Bio-oil
- Biochar
- Heat
- Low emissions

## Zero-Waste and Carbon-Negative?

**Biomass**, now a waste product, becomes:

- ***Energy***—process heat, bio-oil and gases (steam, volatile hydrocarbons convert to energy)
- ***Soil Amendment***—holds water and nutrients persistently, raises pH, reduces fertilizer needs, reduces $N_2O$ emissions by 50-80%
- ***Water Quality Enhancer-*** mitigates N run-off, holds heavy metals, raises pH
- ***Climate Change Mitigation***—sequesters carbon for 1000's of years, minimizes $CO_2$, $N_2O$ and $CH_4$ emissions, creates carbon neutral energy, increased net primary productivity (plant growth & absorption of $CO_2$)

## BIOMASS

## Biomass-to-Energy Concerns

- Use of food or animal-feed as feedstock
- Conversion of cropland to grow biomass
- Conversion of CRP lands
- Industrial-scale production and/or collection of biomass
- Transportation carbon footprint & costs
- Ecologically unsustainable amount of biomass from cropland & forests removed
- Effects on visual quality and wildlife habitat

## Suitable Biochar Feedstocks

- Pulpwood (insect-killed trees)
- Forest Slash and Thinned Material
- Yard and Urban Forest Trimming
- Manure
- Agriculture Crop Waste
- Bluegrass Straw – Spoiled Hay or Straw
- Bagasse (residue from sugar production)
- Methane Digester Residue
- Offal (requires testing)

*~intercepting the waste stream~*

## USFS Biomass Estimates

Fuels Reduction Tons Burned 2008

*~100+ Million (USA)*

Fuels Reduction Tons /Acre

*10 to 40 Tons Typical*

Tons burned In Wildfires

*~1.5 Gt/yr Burned*

## Social Implications of Biomass or Why We Live in the West

Desire rural lifestyles, and/or access to open space…

Want to see abundant wildlife, agricultural lands, and wildlands …

## Resistance to Change

….and typically, we want those lands to stay "in character," meeting our visual expectations.

And that means people tend not to happy about change, especially change they can see.

# ECONOMICS

## USFS Bio-oil Project

Diamond Lake RD, Umpqua National Forest

Sustainable forest bioenergy production using in-woods fast-pyrolysis conversion for bio-oil production and biochar incorporation

16

## Bio-Oil Uses

- Bio-Oil Product is comparable to Bunker Fuel
  - 1 Ton of Slash = 120 Gallons of BioOil
- Bio-oil - refinement possible to #2 Diesel
  - Fischer-Tropsch Process or Blending
- Bio-oil is heavier than water
  - Spill clean up may be an issue in water

## Pyrolsis Product Values

**1 ton Forest Biomass = ~$211 of Products**

- Syngas (fuel for Fast Pyrolysis) = ? lbs of gas
  - Value not included in estimate
  - May be used for Electrical Generation
    - *(Popular Mechanics, Dec, 2008)*
- BioOil (or Bunker Fuel) = 120 gal of BioOil
  - ~ $0.89/gal Houston TX
    - *(Bunkerworld.com)*
- BioChar (or Horticultural Char) = 500 lbs
  - ~$500 - $600.00/ton
    - *(TIME, Dec. 2008)*

## Timber Sale Implications

- D-Bug Timber Sale Example – Umpqua NF
  - Non Timber Sale Acres in project = 2213
  - 18 Green Ton Slash/ac = 9 Dry ton/ac
  - Est. value of products = $211/ton
  - Potential value increase for D-Bug Timber Sale

+$4,202,487

- In addition to Saw Log Value

## Carbon Sequestration Values

1 ton of Biochar is worth about 3 tons $CO_2$

@ $15/ton for $CO_2$ => $50/ton Biochar

@ $30/ton for $CO_2$ => $100/ton Biochar

@ $60/ton for $CO_2$ => $200/ton Biochar

@ $90/ton for $CO_2$ => $300/ton Biochar



## Thank you

Sustainable Obtainable Solutions
P.O. Box 1424
Helena, MT 59624
406-495-0738
www.s-o-solutions.org
gflora@s-o-solutions.org

## Product Output Comparison Values

- Soil Fertility from Biochar: $100/t to $500/t
- Carbon Credits from Biochar: $50/t to $300/t
- Gas for Heat: substitutes @ $10/MBTU for Natural Gas, $20-30/MBTU for Propane, So: $150/t biomass for Gas, $300-450 Propane
- Gas-to-Liquid Fuel: 50 gal per ton (w/o char) @ $2 to $4 /gal Diesel = $100 to $200
- Gas to Electricity: 1MWhr per ton (w/o char) @ $0.04 to $0.12 per kWhr = $40 to $120



## Product Output Comparison Values

| Biochar Value $/tonne: | $0 | $50 | $100 | $250 | $500 | $750 |
|---|---|---|---|---|---|---|
| **Value derived from 1 metric tonne of Biomass:** | | | | | | |
| Biochar Alone (25% yield) | - | $13 | $25 | $63 | $125 | $188 |
| Capital Cost per tonne Biomass per year ~ $100 to $700 | | | | | | |
| $.10/kWh Electric & Char | $100 | $79 | $91 | $129 | $191 | $254 |
| $.25/kWh Electric & Char | $250 | $178 | $190 | $228 | $290 | $353 |
| $3/gal Diesel & Biochar | $150 | $113 | $125 | $163 | $225 | $288 |
| $4/gal Diesel & Biochar | $200 | $145 | $157 | $195 | $257 | $321 |
| Capital Cost per tonne Biomass per year ~ $2,000 to $10,000 | | | | | | |



## Biochar vs. Energy Tradeoff

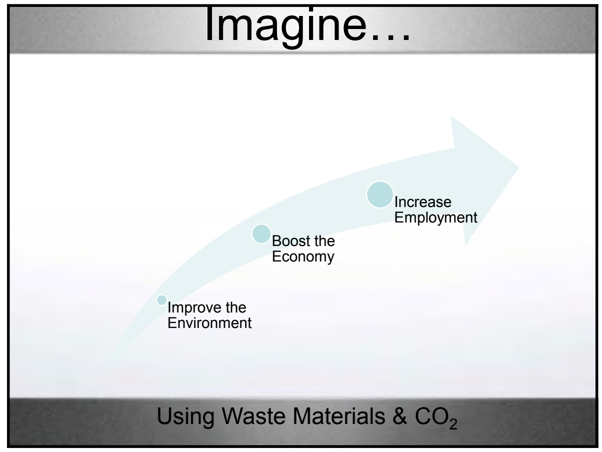
25% Biochar Production = 60-70% of max energy

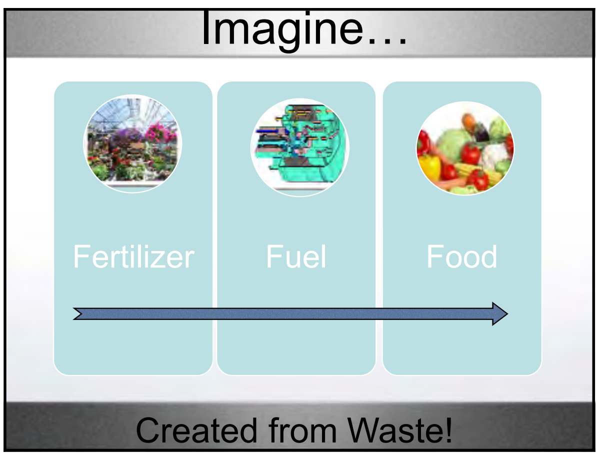
1 mton biomass => 1MWhr (max) = $100 (max)
1 mton biomass => ¼ ton Biochar + 700kWhr

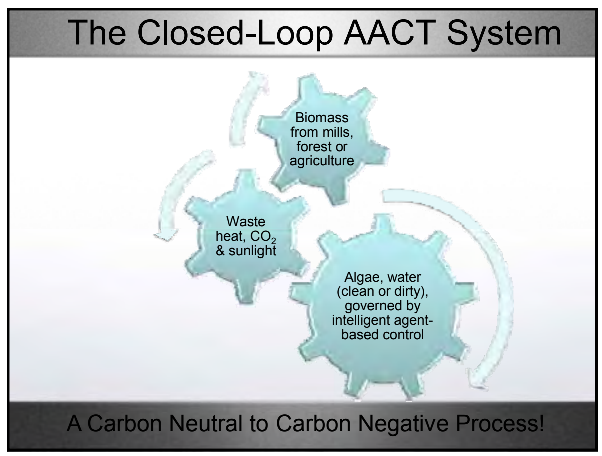
1 mton biomass => 200 liters Diesel (50 gal)
1 mton biomass => ¼ ton Biochar + 140 liters

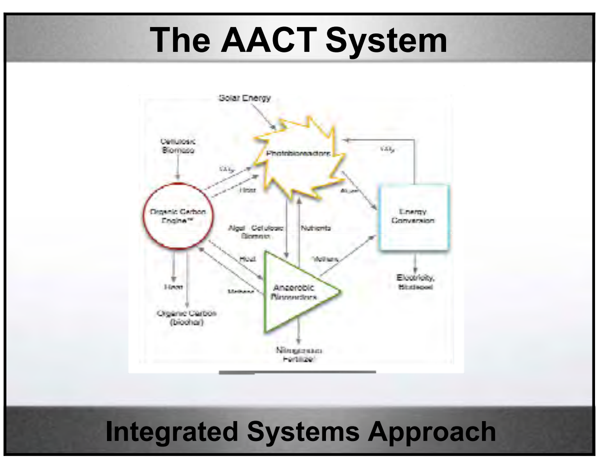
¼ mton biochar => $25 to $125 for Soil Fertility
+ $12 for Carbon = $37 to $137
+ $60-70 max for Energy, or + $100 Heat (Natural Gas), or + $200-250 (Propane)

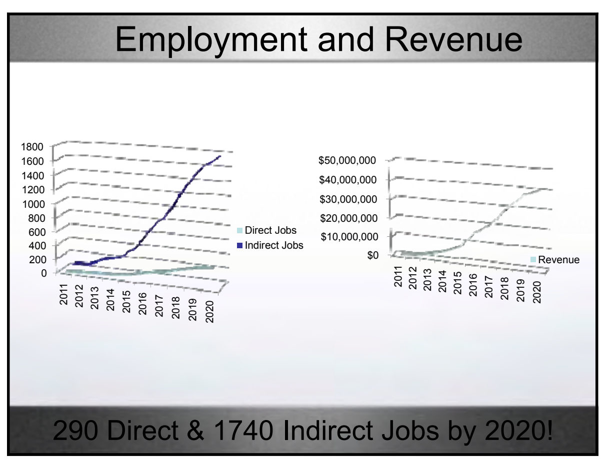

Algae Aqua-Culture Technologies
AACT
"Integrated Smart Technologies
for a Sustainable Future"
Whitefish, MT


Imagine…
Improve the Environment
Boost the Economy
Increase Employment
Using Waste Materials & $CO_2$


Imagine…
Fertilizer
Fuel
Food
Created from Waste!


The Closed-Loop AACT System
Biomass from mills, forest or agriculture
Waste heat, $CO_2$ & sunlight
Algae, water (clean or dirty), governed by intelligent agent-based control
A Carbon Neutral to Carbon Negative Process!


The AACT System
Solar Energy
Photobioreactors
Energy Conversion
Anaerobic Bioreactors
Integrated Systems Approach


Employment and Revenue
1800
1600
1400
1200
1000
800
600
400
200
0
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
Direct Jobs
Indirect Jobs
$50,000,000
$40,000,000
$30,000,000
$20,000,000
$10,000,000
$0
Revenue
290 Direct & 1740 Indirect Jobs by 2020!

# A Vision Becomes Reality…

| | |
|---|---|
| FH Stoltze Land & Lumber Co | • Host for Phase I & In-Kind Support |
| Chairman Chas Vincent | • Letter of Support |
| Senator Ryan Zinke | • Letter of Support |
| Representative Mike Jopek | • Organic Farmer and Supporter |
| Dept of Ag Director Ron de Young | • Letter of Support |
| Dept of Comm Prog Mgr Tom Kaiserski | • Letter of Support |
| NW Power & Conservation Council | • Letter of Support |
| Senator John Tester | • Interested Supporter |
| Governor Brian Schweitzer | • Letter of Support |

Phase I Development Seeking Phase II Funding

# AACT

AACT

*"Integrated Smart Technologies for a Sustainable Future"*

**www.algaeacqua.com**

**333 Lupfer Ave, Whitefish, MT 59937**

# ENVIRONMENTAL QUALITY COUNCIL

PO BOX 201704
HELENA, MONTANA 59620-1704
(406) 444-3742



December 17, 2009

**TO:** Environmental Quality Council members
**FR:** Sonja Nowakowski, EQC staff
**RE:** Biomass background and discussion points

EQC members,

Over the last five months, the EQC has received two background reports discussing issues outlined in House Joint Resolution No. 1. (The most recent report is attached) Using the draft work plan tasks approved by the EQC as a guideline, background reports have discussed:

- biomass availability;
- biomass technologies;
- other state activities in the area of biomass;
- biomass projects and proposals in Montana;
- federal legislation;
- current incentives; and
- potential biomass funding incentives or mechanisms.

To assist the EQC as it moves toward recommendations and findings, staff is providing this memo highlighting potential discussion points for the EQC. The information provided is not complete and is simply provided as a starting point for EQC discussion. During the 2007-08 interim, the Fire Suppression Interim Committee discussed biomass development. Below are a collection of discussion points raised by that committee, biomass developers, other states, government entities, and recommendations from the a bioenergy workshop hosted by the Western Governors' Association:

**Accessibility and Availability on public lands**

- Promote forest management to mitigate wildfire, insects and disease on both a state and national level.
- Explore opportunities to engage federal partners. Recognizing that access to federal land is a significant barrier in northwestern Montana, collaboratively develop and legislatively authorize (where appropriate) proposals for active management on Montana's National Forests.
- Appropriation to DNRC to participate in federal forest management planning activities. (HB 43, 2009)
- Request the appropriate state agency develop a concise, publicly accessible, inventory of biomass available on all state lands. Identify barriers to access. For example, how Fish,

Wildlife & Parks is incorporating forest management into its planning.

- Require the appropriate state agency, along with appropriate partners, to develop a statewide, interagency bioenergy strategic plan to facilitate the development of bioenergy.
- Require the appropriate state agency, along with appropriate partners, to determine the potential import and export market for bioenergy and its byproducts. A study of the potentials could assist industry.

**Electricity Planning and Renewable Requirements**

- Revise the Renewable Portfolio Standard (RPS) to recognize and allow for the cost of certain types of renewable power to be higher than others but still be advanced (revisit RPS cost caps).
- Revise the RPS to allow the thermal output from a cogeneration system to be included in the standard.
- Revise the RPS to require a specific percentage of energy production to come from a specified renewable or efficient technology (Connecticut tier system).
- Revise existing utility regulation to encourage or require a utility to offer "biomass only" requests for proposals (RFP's) that match in time a utilities needs for new firm generation or additional renewable power and carbon offsets. (RPS)
- Review regulated utility resource planning requirements. MDU prepares and files an "integrated resource plan" every two years. NorthWestern Energy files a "portfolio and procurement plans" showing how it will provide electricity supply "at the lowest long-term total cost". The PSC then decides on the prudence of a utility's resource procurement practices. The PSC has some flexibility to look at social costs or benefits, but it is limited.

**Funding, Grants, & Loans**

- Expand funding available for grants administered through the Fuels for Schools program.
- Nongovernment entities, like private foresters and wood processing plants, are not eligible for Renewable Resource Grant and Loan program funding. In promoting biomass, nongovernmental entities should be encouraged to team with government partners to seek grants from the RRGL program.
- Recognizing that the $100,000 cap for RRGL grants is inadequate for some projects, biomass developers should be advised that projects that receive RRGL funding receive grants and loans from multiple sources.
- Investigate funding for the Alternative Energy Revolving Loan program. The loan amount of $40,000 limits the size of projects currently available for the program. Funding for the program from air penalty fees was fully subscribed by December 2009. The amount of funds for loans is reduced to the amount of money revolving back to the program and future air penalties.
- Provide funding opportunities for a biomass gasification pilot projects in Montana.
- Encourage the federal government to revise the scale of cellulosic ethanol plants eligible for federal support to include smaller scale facilities. Provide state-level coordination of cooperative grant applications to consolidate individual, small-scale efforts in order to reach the large scale required by federal programs.

- State-level Biomass Crop Assistance (BCAP) program that provides financial assistance to producers or entities that deliver eligible biomass material to designated biomass conversion facilities for use as heat, power, biobased products or biofuels.
- Provide additional funds or incentives for activities that produce biomass fuels (for example, fire prevention treatments and diversion of residues from agriculture burning.)

**Tax Incentives**

- Pursue legislation similar to Oregon's tax credit program for biomass, which is applied to all income by a taxpayer on a consolidated return, not just the income generated by the investment. Legislation also could increase Montana's 35% investment credit to a 50% investment tax credit for renewable energy installations.
- Develop an income tax credit for removing and processing biomass for energy, similar to an Oregon law (HB 2210). Senate Bill No. 146, requested by the 2007-08 Fire Suppression Committee, would have provided a similar credit against individual income or corporate income taxes for biomass collection or production. The bill was tabled in Senate Taxation during the 2009 legislative session.
- Provide tax incentives for advanced biomass technologies. (Beyond Clean and Green).
- Provide incentives to utilities and cooperatives that add biomass to their portfolios. (Tax credits)

# DNRC perspectives on woody biomass energy development in Montana
## Potential Discussion Points

Provided by Angela Farr, DNRC

In recent years, significant public funding has been available for renewable energy projects, combined heat and power, biomass utilization, and the transportation of biomass for energy. Many lessons can be learned by investigating why some biomass CHP projects have been unable to come to fruition in spite of the fact that on its face, public policy appears to support them. This analysis provides some of the answers to that question and some suggestions for moving forward, but by no means should be considered a complete understanding of all of the issues associated with biomass energy development.

In our great state of Montana, several wood products manufacturing businesses have investigated the feasibility of developing CHP plants that would sell electricity to the grid and make productive use of a portion of the waste heat associated with steam production. One major obstacle to their feasibility has been the cost of making electricity with biomass, particularly in relation to the inexpensive electricity rates in our region. In addition, some of the incentive programs available at the federal level have not been a good fit for these potential projects. This raises the question: what are the goals of federal incentives? What are our goals in Montana? What ***should*** a biomass energy incentive program's goals be?

One issue that has been recognized in subsidy programs is that biomass, and especially forest biomass, is relatively low in density and expensive to collect and transport. The recent Biomass Crop Assistance Program's (BCAP) Collection, Harvest, Storage and Transportation program has attempted to address this. But one could argue that by subsidizing transportation of this material, you are primarily enabling one to transport it longer distances more affordably, which in most instances, increases the fossil fuel use associated with biomass energy production. It is an oversimplification, but still holds some truth in that if we incentivize transportation, that's what we will get more of. There are several other issues with BCAP as well, most of which raise the question: what was the goal of this program?

Another set of incentives, offered by the U.S. Department of Energy for renewable energy and CHP projects, requires that CHP plants achieve at least 60% efficiency. If our primary goal is to recover the maximum energy out of every particle of biomass, efficiency requirements make sense. But is that the right goal? Are we requiring that of other energy sources? Typically, no, we are not. One could argue that we should be. But in order to get built, energy producing plants also have to be practically achievable and economically feasible. Maximizing efficiency is a good goal, but at some point there is a cost/benefit calculation that needs to be made, in order to ensure the most effective use of public funds. That is, if we can spend a fraction of the public money that would be needed to get to 60% efficiency and achieve 40 or 50%, wouldn't that be more economically efficient as well as increase energy efficiency?

Most energy produced in this country is not combined heat and power – it is straight electrical production between 25-30% efficient in energy recovery, regardless of fuel. If all of the waste heat associated with electrical production is used for some productive purpose, CHP can be highly efficient, e.g., 80-90%. In the case of Montana's proposed projects at sawmills, most would be sized between 12 and 18 MW. This size strikes a balance between return on investment and potential fuel costs and availability. The Return On Investment gets better as plants get larger, because small equipment costs almost as much as large equipment, but the fuel gets more expensive as the plants get larger, mostly due to increasing transportation costs. At this projected size range (12-18 MW), the sawmills would be able to use some of the waste heat for drying lumber and other industrial uses, but would not use enough waste heat to get to 60% efficiency. Again, the question … isn't 40-50% better than straight electricity at 25%? Are there are good public reasons for the 60% requirement that override the public good associated with slightly less efficient plants?

Maximizing efficiency will generally drive CHP plants to be sized smaller, to match localized heat demand. On the other hand, maximizing biomass utilization will drive plants to be larger. The Forest Service woody biomass grant program tends to make awards to projects that project higher volumes of biomass utilization. For a variety of reasons, neither of these strategies is appropriate for what we want to promote in Montana.

Unlike many western states, Montana still has a functioning integrated wood products industry, in which primary manufacturers mill logs into boards, and secondary manufacturers take the byproducts of these processes (sawdust, shavings and chips) to make wood pellets, particleboard, fiberboard, and pulp/paper. We also have one large CHP plant at our pulp mill that burns ground logging residue and black liquor (byproduct of pulp) to generate electricity and heat for the plant. Many other mills have boilers to burn their own waste for process heat, but are not currently generating electricity. Since 1990, 27 mills have shut down in Montana; those that remain have been struggling for some time. This infrastructure is a valuable asset to the state, not only due to the jobs and economic activity they provide, but perhaps even more importantly, due to our forest management challenges of insects, diseases, and wildfire. Without uses for some of the byproducts of forest management, that management becomes extremely expensive — surrounding states that have lost this infrastructure are paying 2-4 times the per acre treatment costs.

So a central goal in Montana is to maintain and strengthen the infrastructure we currently have. Bringing in new large biomass users in close proximity to existing biomass users would be disruptive in most cases/locations.[1] Sizing CHP plants for maximum efficiency would require substantially more financial assistance in order to truly strengthen these businesses. If instead we built incentives to maximize the carbon benefits of forest management in Montana, we could achieve all of our goals including greenhouse gas reduction, economic stability, and forest health management.

Research from the Consortium for Research on Renewable Industrial Materials (CORRIM) suggests that the best overall forest management-forest products scenario from a carbon perspective is: 1.) manage forests to maintain or enhance their carbon sequestration capacity (helping forests adapt to warmer and drier conditions, and improving resilience to insects, disease and wildfire are part of this); 2.) convert as much of the wood removed as possible into solid wood products (boards, beams, plywood, particleboard, etc.) to maximize sequestration of carbon for as long as possible, while substituting wood for far more energy intensive products like concrete and steel; 3.) use the remaining woody material to offset fossil

[1] There are significant exceptions to this. Considerations of supply and proximity to existing users are important. There are several geographic areas in the state that do not currently support milling infrastructure, and thus would be unable to capture the CHP alternative without concurrently establishing a significant industrial heat user. In these cases, establishing standalone new biomass users sized to the locally available supply would be appropriate.

fuel use for heat and/or electricity. Thus, the goal of maximizing the carbon benefit aligns very well with the goal of strengthening and stabilizing our integrated forest industry.

So how can incentives be structured to accomplish this? They should minimize disruption on current wood users, particularly those users that convert wood into long-lived solid products that sequester carbon in the near term. A few thoughts about how to achieve this: .1) exclude clean mill residue from BCAP and similar programs to avoid skewing the value of material that gets used in solid wood products; 2.) consider some kind of siting requirement for incentive programs that would only allow tax credits, grants or other financial incentives for projects located a certain distance from a current biomass user; and 3.) ensure that carbon management legislation accounts for the value of sustainable forest management, and the value of substituting solid wood products for more energy intensive materials that do not sequester carbon. This list is a start; many more approaches are possible, and there are tradeoffs. The point of this analysis is to frame this problem in terms of what we are truly trying to achieve, and urge policy makers to approach any new incentives with this in mind.