

Final Report

Oregon BEST Biobased Products Rural Outreach Project

Prepared by

The Institute for Natural Resources
Oregon State University

for the

Oregon Built Environment & Sustainable Technologies Center

June 2009



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Port of Tillamook

The Institute for Natural Resources

Created by the Oregon Legislature through the 2001 Oregon Sustainability Act, the Institute for Natural Resources' mission is to provide Oregonians with ready access to current, relevant, science-based information, methods, and tools for better understanding natural resource management challenges and developing solutions. The Institute for Natural Resources is an Oregon University System institute.

Executive Summary

Many of Oregon's rural communities have faced increased economic stress over the last several decades, particularly as many of them have lost employment associated with natural resources such as logging. Isolation has also been a factor in Oregon rural communities' economic struggles. Oregon has extensive potential for biobased product development due to its wealth of natural resources, which may provide a means of helping rural communities create new, sustainable income sources. Rural communities can benefit a great deal from help identifying and acting on those possibilities.

The Oregon Built Environment & Sustainable Technologies Center (Oregon BEST), an independent nonprofit organization, is a catalyst for research and university-industry collaboration in green building and renewable energy to create business opportunities and jobs in Oregon. Oregon partnered with the Institute for Natural Resources (INR) to conduct a series of workshops in rural communities across the state to identify and evaluate bio-product opportunities. The overarching goals of the project were to promote rural economic development by connecting rural communities with the technical and policy resources needed to assess and advance biobased energy and product development opportunities; and to inform the Oregon BEST research agenda related to biomass energy and biofuel products. This report focuses almost exclusively on the workshop component.

The INR project team identified three rural regions based on a combination of biobased product potential, local willingness to help coordinate the workshops by identifying locations and services, and the ability to rapidly generate lists of potential participants sufficient to make the workshops meaningful for everyone involved. The northwest, coastal region comprised Clatsop and Tillamook counties; the workshop was held in the community of Tillamook. The south, central region included Klamath, Lake, Josephine, Jackson, and Douglas counties and was held in Klamath Falls. Although the invitation list included the five counties, a commissioner from Coos County and another from Lane County also attended. The northeast region covered Wheeler, Morrow, Umatilla, Wallowa, Union, Baker and Grant counties; the workshop took place in Pendleton, which is in Umatilla County. In all, interests from 16 counties attended the workshops.

Participants represented a range of interests, though not every interest was represented at all workshops. In general, however, participants, including presenters, comprised biobased researchers, producers, cooperatives and developers; representatives from wood products companies; local governments; non-profit groups; economic development districts; tribal representatives; various state agency staff including but not limited to representatives for economic development and energy policy; community college faculty; and, federal land management and economic development personnel.

In addition to research needs, participants brought up important non-research issues involving policy and incentives; education and communication; infrastructure, capacity and planning; funding; and cluster development. A common theme across workshops was the need for a single source of reliable information regarding science and technology for biobased products along with a means for businesses and communities to find out who has what in terms of source materials or projects under consideration or development; who

might be searching for research, development and/or investment partners; and who is doing research on various products and technologies.

Based on activities and responses at the three workshops, Oregon BEST may want to pursue any or all of the following options for near-term research investment: Research that specifically supports regional cluster development; research based on product interest and potential; research that drives new product opportunities and acceptance and creation of a list of researchers who would be willing to serve as expert review team members who can advise individuals and communities about whether project design includes the correct and/or most current economic and technical calculations in order to better ensure product viability.

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1.0 Project Goals and Objectives

Many of Oregon's rural communities have faced increased economic stress over the last several decades, particularly as many of them have lost employment associated with natural resources such as logging. Isolation has also been a factor in Oregon rural communities' economic struggles.¹ Oregon has extensive potential for biobased product development due to its wealth of natural resources, which may provide a means of helping rural communities create new, sustainable income sources. Rural communities can benefit a great deal from help identifying and acting on those possibilities.

There is significant state-level policy support for biobased product development. The governors of Oregon, Washington and California formed the West Coast Governors' Global Warming Initiative (Initiative) in 2003 to collaborate on policies for reducing greenhouse gas emissions they could pursue individually and jointly in order to protect the economy, health and environment of the west coast states. Following the Initiative, Oregon Governor Ted Kulongoski and Secretary of State Bill Bradbury appointed a Governor's Advisory Group on Global Warming (Advisory Group) to develop an Oregon climate change strategy. In 2004, the Advisory Group published its report, Oregon Strategy for Greenhouse Gas Reductions² to complement the West Coast Governors' Global Warming Initiative program. The Governor established the Governor's Climate Change Integration Group during 2006 to continue and expand on the Advisory Group's recommendations.

In 2007, four Canadian premiers and seven U.S. governors, including the members of the West Coast Governors' Global Warming Initiative, formed The Western Climate Initiative (WCI). That same year, the Oregon legislature passed several bills signaling its commitment to developing in-state renewable energy sources. Legislation included increases in energy tax credits for installation and use of renewable and biobased energy systems, renewable energy standards for utilities, and incentives for collection of raw materials as well as production and use of biobased fuels.

In 2007, the Oregon Built Environment & Sustainable Technologies Center (Oregon BEST) was established as a part of the Oregon Innovation Council's legislative recommendations. It is an independent nonprofit organization working to utilize and enhance Oregon's research capabilities in green building and renewable energy to support economic growth in the state. Oregon BEST was interested in finding ways that biobased product development could add to its renewable energy research portfolio while stimulating rural economic development. Oregon BEST partnered with the Institute for Natural Resources (INR) to facilitate a series of workshops in rural communities across the state. The overarching goals of the project were to promote rural economic development by connecting rural communities with the technical and policy resources needed to assess and advance biobased energy and product development opportunities; and to inform the Oregon BEST research agenda related to biomass energy and biofuel products.

¹ Meyers, Michael. *Structural Employment Changes in Rural Oregon Over Past 25 Years*. Oregon Labor Market Information System, Oregon Employment Department 2006. Available from http://www.qualityinfo.org/olmisi/ArticleReader?p_search=rural&searchtech=1&itemid=00005197.

² See at <http://www.oregon.gov/ENERGY/GBLWRM/docs/GWReport-Final.pdf>

The project involved three integrated components (project activities).

Component 1: OUS biobased products capabilities inventory

- identify areas of research and interest among the faculty; and
- identify research opportunities for Oregon BEST in biobased products, including opportunities to collaborate on research, opportunities for shared research facilities, and opportunities for funding Oregon BEST research efforts.

Component 2: Outreach to rural Oregon

- inform participants of the status and potential of biobased resources and products, policy support, and the potential links to rural economic development;
- have participants share knowledge, preferences, barriers and incentives to participating in biobased product markets;
- identify applied research opportunities that could leverage local biobased product efforts; and
- begin to craft and prioritize locally-based economic development opportunities that build on specific biobased products.

Component 3: Biobased products symposium

- inform bio-products service providers, industry, and researchers about the state of bio-products in Oregon;
- refine the core research opportunities for Oregon BEST by further identifying Oregon bio-product industry needs and opportunities that could be met through research; and
- link researchers, biobased industries, and service providers interested in pursuing collaborative research projects to leverage bio-product industry projects.

It should be noted that, while there is some discussion of all three components, this report focuses almost exclusively on Component 2 covering rural Oregon outreach activities and results of those activities. Component 1 mainly consisted of documenting information from websites and confirming that information with OUS faculty; and Component 3 was restructured to be part of a larger symposium effort led by Oregon SunGrant.

2.0 Descriptions of Project Activities

2.1 Component 1: OUS Biobased Products Capabilities Inventory

To capture the breadth of knowledge and research abilities within OUS, INR developed an Excel database of faculty working in biobased fields. An initial list of 77 faculty members was developed from a combination of searching through Oregon BEST's membership and web searches of academic unit faculty lists at Oregon State University, Portland State University, the University of Oregon, and the Oregon Institute of Technology.

After documenting background information on faculty members' interests and fields of research from their websites, several faculty were removed from the list as their work did not involve biobased products readily useable for rural economic development (e.g., bioremediation and other biobased fields such as development of biomedical products). INR then attempted to contact each of the remaining 50 faculty members (See attached Excel file) to confirm their research's applicability to biobased products.

The first contacts were made by phone. When faculty members were not available voicemail messages were left, and INR attempted to contact them up to three times. After that point, an e-mail was sent. If the faculty member did not respond, INR relied solely on the information from faculty websites. If a faculty member answered the phone INR either spoke with them at that time, or called back at a more convenient time. Overall INR was able to speak to 17 of the 50 identified faculty (35%) who have an interest or research in biobased products). Of the 50 faculty, three are from the Oregon Institute of Technology; 43 from Oregon State University, and two each from Portland State University and the University of Oregon. Twenty-one of the 50 faculty were not members of the Oregon BEST faculty, as represented in the Oregon BEST on-line database in May 2009.

2.2 Component 2: Outreach to Rural Communities

Oregon has a diverse geography, from moist coastal environments and other heavily timbered regions to dry interior landscapes. Various areas of the state therefore have different biobased product possibilities. There are also different potential feedstocks as a result of developed industries, such as dairies in Tillamook County and larger farming operations in the northern and eastern part of the state.

INR staff began workshop site selection by assessing the potential for different types of biobased product interests in different regions of the state. Due to funding and timing limitations, it was not possible to hold workshops covering every county. INR selected different areas to provide a broad range of biobased product possibilities with the assumption that doing so would help generate a range of research needs. Staff initially approached local OSU Extension Program personnel in the different areas to gauge local interest in the workshops. In one instance, Extension indicated enthusiasm for a workshop; however, local contacts were not able to identify enough business interests in the area to warrant making the location a workshop site.

INR convened three community outreach sessions over the course of the project period. These day-long "Biobased Products for Rural Economic Development" workshops were designed to provide an information-sharing forum for researchers, producers, government officials, and other interested parties. The specific aims were to:

- inform participants of the status and potential of biobased resources and products in their region, biobased products policy support, and the potential links to rural economic development;
- have participants share knowledge and identify local biobased product opportunities and preferences, local barriers and incentives to participating in biobased product markets, and applied research opportunities that could leverage local biobased product efforts; and

- craft and prioritize locally-based economic development opportunities that build on specific biobased products.

The objective for each event was to identify near-term research opportunities that Oregon BEST could invest in to promote Oregon's rural economy.

2.2.1 Community Outreach Locations

INR identified the three rural regions, shown in Figure 1, based on a combination of biobased product potential, local willingness to help coordinate the workshops by identifying locations and services, and the ability to rapidly generate lists of potential participants sufficient to make the workshops meaningful for everyone involved. The northwest, coastal region (highlighted in yellow) comprised Clatsop and Tillamook counties; the workshop was held in the community of Tillamook. The south, central region (highlighted in green) included Klamath, Lake, Josephine, Jackson, and Douglas counties and was held in Klamath Falls. Although the invitation list included the five counties, a commissioner from Coos County and another from Lane County also attended. Those counties are shown with diagonal stripes. The northeast region (highlighted in blue) covered Wheeler, Morrow, Umatilla, Wallowa, Union, Baker and Grant counties; the workshop took place in Pendleton, which is in Umatilla County. The regions share some common rural characteristics but face their own challenges and opportunities for economic development.

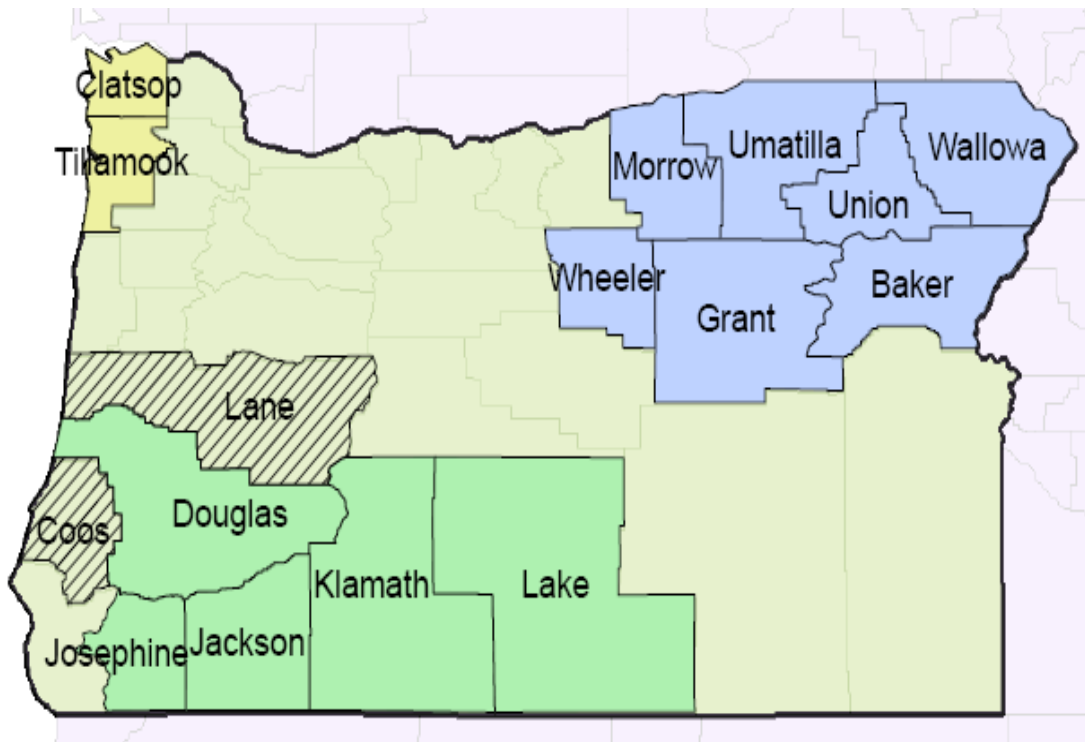


Figure 1: Map of Community Outreach Locations

2.2.2 Participant Selection

The project team initially worked with local OSU Extension agents and other local contacts to identify people representing local industry clusters (e.g., bio-fuel producers, wood products enterprises, dairy farmers); community groups such as cooperatives, trusts, economic development associations, etc.; government, including city and county elected officials and various state and federal agency representatives; and the general public in each of the selected communities. The Extension agents were also invited to participate.

Participants represented a range of interests, though not every interest was represented at all workshops. In general, however, participants, including presenters, comprised biobased researchers, producers, cooperatives and developers; representatives from wood products companies; local governments; non-profit groups; economic development districts; tribal representatives; various state agency staff including but not limited to representatives for economic development and energy policy; community college faculty; and federal land management and economic development personnel.

Invitation letters were sent to the participants via e-mail attachments. Appendix A contains a sample invitation. Project team members also made follow-up phone calls to the invitees as appropriate. Table 1 shows the number of people who participated in the workshops. The total number does not include the project team; however, it includes presenters, as they were also actively involved in open sessions and afternoon working sessions, acting as facilitators, hosts at topic stations, roving support or members of small group discussions.

LOCATION	RSVPED	PARTICIPANTS	PRESENTERS	TOTAL ATTENDING
KLAMATH FALLS	35	28	4	32
TILLAMOOK	37	29 ¹	5	34
PENDLETON	50	29	4	33

Table 1: Workshop Participants

2.2.3 Description of Community Workshops

INR designed an overall agenda for the outreach events but planned for them to be flexible in order to best serve participants' needs in each location. The team also planned to modify each event based on participant responses from the previous outreach event. Many of the responses to each workshop are reflected in the changes that were made in the hand-out materials and presentations at each event.

The project team provided the following at each workshop:

- an agenda (Appendix B);
- handouts describing Oregon BEST and INR (Appendices C and D);
- a list of participants;
- a biobased product glossary (Appendix E); and
- a list of Oregon's Biomass Energy Resources (Appendix F).

Workshops were originally designed to be two-hour workshops more along the lines of listening sessions to determine local needs. Early responses from contacts in local communities indicated that people wanted more than an opportunity to talk about their interests; they wanted two-way information sharing and were interested in hearing about topics such as policy support and current research. Therefore, at each of the workshops presentations regarding Oregon BEST, policy support, economic development, and applied research regarding biobased products were given.

Contacts also asked if the workshops could be expanded in order to make them more attractive to people who would be driving long distances to attend. The project team redesigned the workshops to be approximately six-hour events that would include lunch as incentives to attend.

The number and type of participants were limited, and workshops were by invitation only, to ensure that participants had genuine interest in pursuing biobased product development. In each instance, the project team made certain that workshop seating arrangements comprised groups of eight or ten at tables, rather than auditorium style seating, to maximize interaction and networking. Lunch was provided in the workshop room to encourage additional networking and informal discussion. Open sessions followed the presentations so that anyone asking a question or sharing information would be heard by the whole group; and facilitators encouraged anyone in the group—whether presenters or participant—to feel free to answer any questions asked.

Klamath Falls, Oregon • January 30, 2009, 9:00AM – 2:00PM

INR targeted a five-county, generally south-central Oregon region based on its concentration of woody biomass as a dominant product feedstock. INR emphasized to invitees, however, that biomass product exploration was not the sole workshop focus. Community members, including biobased producers, county commissioners, tribes and state and federal government representatives from Douglas, Jackson, Josephine, Klamath and Lake counties were invited to a six-hour workshop at the Oregon Institute of Technology in Klamath Falls on January 30, 2009. Upon invitation acceptance, participants received the agenda and various materials for background information.

Three organizations endorsed the workshop: South Central Oregon Economic Development District, the Collins Pine Company, and Oregon Solutions. Of the 35 invitees who agreed to attend, 26 actually participated with an additional 5 people observing.

At the workshop, participants ultimately representing seven counties, including Coos and Lane counties attended. They also shared information and ideas through an open discussion session before lunch and an open-house set-up in the afternoon. During the open-house session, participants were asked to move about the room to voice their ideas and questions at tables hosted by INR staff and presenters covering the following issues: pretreatment and recovery; product selection and use; secondary recovery; source material – inventory & recovery; policy; and, economic development capacity (incentives, education, infrastructure & clustering). Workshop staff engaged participants in discussion and took note of ideas and questions.

Workshop participants described their specific interests in bio-products (Figure 2). Each row represents a respondent's interest, though one respondent discussed more than one interest. Responses are grouped by product. There is significant overlap across products in the perceived opportunities and barriers for economic development. At the end of the workshop, several participants expressed that they were pleased with the workshop and felt that the most significant benefits were the opportunities to network and to exchange information on biobased product opportunities. Based on the Klamath Falls workshop feedback and project team observations, modifications were made for the design of the next workshop held in Tillamook, Oregon.

Tillamook, Oregon • April 2, 2009, 8:30AM – 2:30PM

The coastal northwest region of Oregon provided the site for the second workshop. Because of the forest cover along with the dairy industry and an existing biodigester run by the Port of Tillamook, INR assumed dominant interests would include woody biomass and materials for biodigestion, as the Port of Tillamook is looking for ways to expand the biodigester. INR invited community members to attend a six-hour workshop at the Oregon Department of Forestry Conference Room in Tillamook on April 2, 2009. Those who agreed to attend were then sent the agenda and background materials by email.

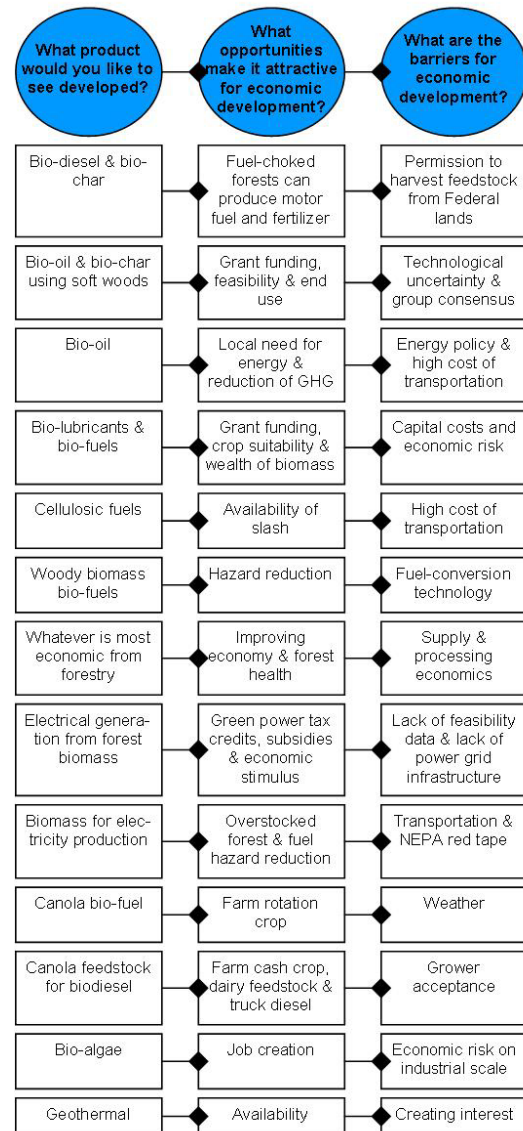


Figure 2: Klamath Falls Participant Interests

Five organizations endorsed the workshop: Tillamook Futures Council, Tillamook County, the Port of Tillamook, Oregon State Extension Service, and Oregon Solutions. With the help of local community members, INR developed a list of 90 invitees, 37 of which agreed to attend. Twenty-eight actually participated. In addition, a local reporter covered the event. Participants included university researchers, local professionals, and local government officials. Their interests were broad, but could be grouped into the following four main categories: solid waste, animal waste, timber, and value added products/business & entrepreneurship.

At the beginning of the workshop, participants were asked what motivated them to attend the workshop and what biobased products they were interested in seeing developed (see Figure 3). This exercise illuminated participants' broad motivations and interests. Some participants had general expectations of the workshop while others had very clear and narrow ones. Participants with broad interests were able to see what fields were

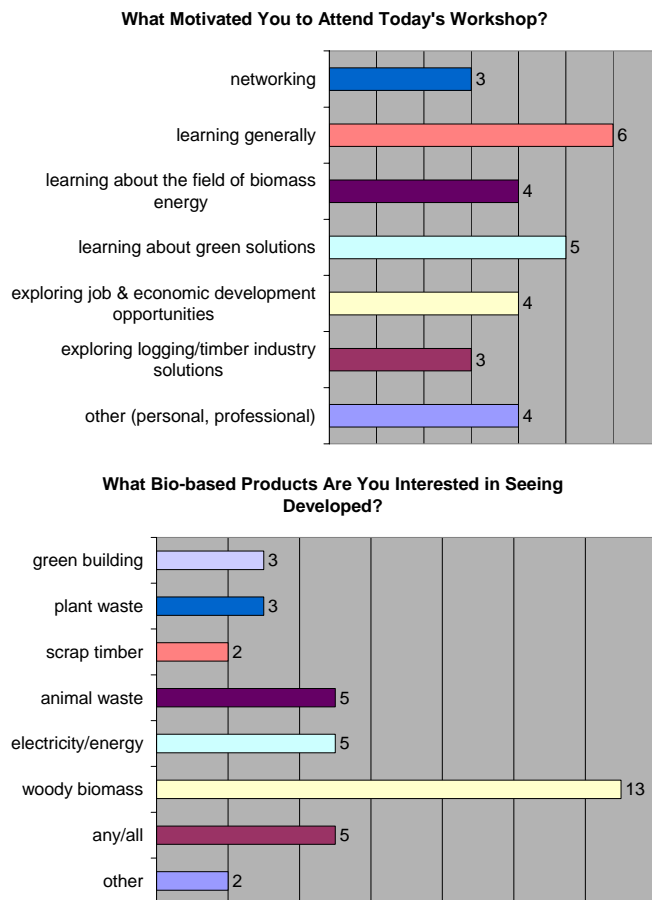


Figure 3: Tillamook Participants Motivations and Interests

represented, while participants with narrow interests were able to see how they might benefit from other participants' interests. INR was able to make informed decisions to steer the course of the workshop. Following presentations, the morning session closed with a one-hour open question and answer session.

During the afternoon session, participants interacted in groups organized by shared interest to discuss:

- what biobased product(s) they would like to see developed;
- what research questions needed to be answered;
- what the challenges and barriers to producing this product were; and
- who the potential partners are.

The groups were organized in part around the motivations and interests expressed in the morning session. The small groups then shared their ideas with the larger group before the workshop adjourned.

The purpose of the afternoon small-group session was to begin identifying potential biobased products and concomitant research needs, barriers and potential partnerships needed to move from idea to product. People were given options of how to organize, and groups chose to organize around four interest areas: solid waste, biodigestion/energy production, further exploration of wood as a partial substitute for non-renewable materials in various products, and woody biomass utilization.

The solid waste group developed rough plans and questions regarding two products. The first was electrical generation utilizing woody biomass with a presumed 20 megawatt output. Potential issues included supply, developing contracts, public sentiment, and truck traffic. There did not appear to be any research issues.

The second was a set of products combining recyclable plastics and construction and demolition woody materials coming into the landfill. The group identified potential products such as outdoor furniture and landscaping materials (e.g. pots) with and without woody debris. Challenges included, among other things, permitting and regulations, materials recovery, lack of market opportunities, transportation costs, and inventory.

Research needs included chemistry for the products and product life cycle. The group identified 22 potential partners including local and national private enterprises, state and federal agencies, a nonprofit community development financial institution and others.

The group concerned with expanding the local biodigesters considered strategies to expand the biodigester in terms of useable inventory and in output products. Because the biodigester currently utilizes waste from local dairies, potential secondary products in addition to energy included liquid effluent for fertilizer as well as fiber. Research questions included whether heat from the digester could be used to dry the fiber, what kinds of additional feedstocks could be used, and how liquid effluent could meet nutrient needs to go back out onto fields.

Potential barriers included transportation, being able to obtain enough tax credits to make the project viable and determining the appropriate engine-generator set. The group identified at least 12 potential partners, including state and federal agencies, public utilities, mills, nurseries, the various universities in the Oregon University System, carbon banks, the Tillamook County Creamery Association and the local public works solid waste division.

The group considering exploration of wood as a partial substitute for non-renewable materials in various products identified two potential products: wood fiber as a substitute in various non-wood fencing and as a partial substitute in vinyl products. Producing such products can expand local markets and diversify the economy, offering increased stability.

The group suggested developing an inventory of local entrepreneurs and ideas in biobased products and identified the Oregon Wood Innovation Center as a partner to provide expertise to help entrepreneurs. They also suggested identifying green market needs and developing a 'solution industry' to respond. It would need to be developed at an appropriate scale to take advantage of biomass in the region. Research needs include more information on the composition needed for various products.

The group exploring woody biomass utilization concentrated on issues concerning the need for alternative uses. There was group consensus that there is significant inventory, and using it can benefit forests and the environment. Needed research include estimating and documenting a sustainable inventory level for different uses, the effects of removal on soil productivity and determining opportunities for mixed feedstock such as forest biomass, recycled wood, garbage and construction demolition. Potential barriers include financing, market uncertainty, contracting, harvesting and transportation costs, emission limits and being able to develop projects at the appropriate scale for the community. There is partnership potential with utilities, governments and the private sector.

Pendleton, Oregon • April 7, 2009, 8:30AM – 2:00PM

INR held its third workshop at Blue Mountain Community College in Pendleton on April 7, 2009. Preliminary contacts indicated regional interest primarily in woody biomass and biofuels. Those indicating they would attend were sent the agenda and background materials by email. GreenWood Boardman Tree Farm, The Collins Companies, Greater Eastern Oregon Development Corporation and Oregon Solutions endorsed the workshop. Working with the local Extension office and the Small Business Development Center and

Blue Mountain Community College, which supplied the initial list of potential participants, INR used a snowball technique—asking initial contacts to suggest additional names—to identify participants throughout a seven-county area comprising Umatilla, Wheeler, Grant, Morrow, Union, Wallowa and Baker counties.

Based on the Tillamook workshop feedback and observations, the project team again made slight modifications to the workshop design. Similar to the Tillamook workshop, participants were asked what motivated them to attend the workshop and what biobased products they were most interested in seeing developed (See Figure 4). Pendleton participants indicated different motivations and interests than those at Tillamook. Less emphasis was placed on forest resources than at the other workshops due to the higher potential for cellulosic and oil seed source materials in several of the counties represented in Pendleton.

During the afternoon session, participants worked as a large group to discuss specific biobased products, technical and research questions, economic opportunities; potential barriers, and potential partners. Six biobased products were discussed to varying degrees – a methane generator, biomass, biochar, biobased by-products, bio-diesel, and briquettes. In some cases, one individual was the proponent of a biobased product and had projects underway (i.e., biochar and on-site biodiesel use), in other cases several of the participants had begun researching the potential of a product (i.e., briquettes) but were not actively pursuing its development due to barriers such as competition and transportation. In all cases, a fundamental question regarded the economic viability of these products to Eastern Oregon and what the best science has to offer.

2.3 Component 3: Biobased Products Symposium

Based on the findings from Components 1 and 2, INR was to organize and facilitate a symposium of bio-products industry representatives, service providers, and OUS researchers for the purpose of:

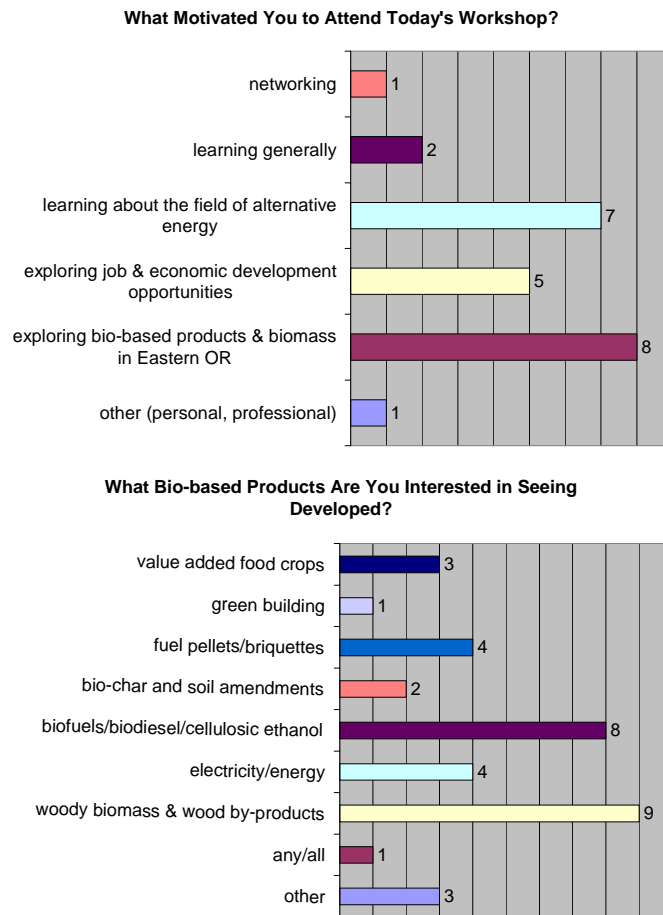


Figure 4: Pendleton Participants Motivations and Interests

- informing bio-products service providers, industry, and researchers about the state of bio-products in Oregon;
- refining the core research opportunities for Oregon BEST by further identifying Oregon bio-product industry needs and opportunities that could be met through research; and
- linking researchers, biobased industries, and service providers interested in pursuing collaborative research projects to leverage bio-product industry projects.

The benefits of the symposium were to include: a broader understanding of the landscape of bio-products industry needs and research capabilities in Oregon; the development of a network of bio-product industry, service providers, and OUS researchers interested in engaging in collaborative research to promote Oregon's rural economy; the development of a bio-products research agenda; and, most importantly, the ability to apply the research information tactically and strategically to commercialize research to promote economic development opportunities in Oregon within the scope of the Oregon BEST mission.

However, during the timeframe of this project, a number of other biobased meetings were scheduled in the region, including the International Biomass Conference and Trade Show in Portland (April 2009), the Pacific Northwest Biochar meeting (April 2009), and a series of meetings being organized by SunGrant and the OSU College of Agriculture. In January 2009, Lisa Gaines met with Jan Auyong of Oregon SunGrant to discuss the series of biobased product workshops that SunGrant was organizing for later in 2009. After consultation with David Kenney, it was determined that a separate Oregon BEST biobased product symposium aimed at networking researchers and industry would overextend potential participants. Instead, Lisa Gaines (INR) has been a contributing member to SunGrant's planning committee which is made up of academic, industry and agency representatives. INR, on behalf of Oregon BEST, will also be providing the names and contact information of selected individuals who participated in the Oregon BEST workshops so that the primary organizers of the upcoming SunGrant workshop series can notify them of the upcoming workshop(s). Oregon BEST will be listed as a supporter/endorser of the workshop series.

The SunGrant workshop series – *Biofuels, Bioenergy, and Bioproducts—What is Oregon's Niche?* – will feature three topics, each presented in a separate workshop. The first workshop, *Topic #1: Transportation Fuels* (Appendix G) will be held June 29, 2009 at the OSU CH2M Hill Alumni Center. Aimed at an audience of academic, industry, and governmental participants the expected outcomes of the transportation fuels workshop include:

- providing an overview of Oregon's role in the bio-products industry and to frame any obstacles within the economic and policy context that might hinder Oregon to benefit from its niche;
- identifying obstacles to the expansion of the industry; and
- reporting on progress toward overcoming obstacles.

Proposed outputs include:

- a roadmap, "Biofuels Roadmap-Characterization of Oregon's Biofuels Niche"; and

- a website to do updates to the roadmap and provide additional information about Oregon's Niche (managed by Sun Grant with assistance from INR grad students) .

Throughout the planning process, information learned through the Oregon BEST community outreach workshops has informed the development of the SunGrant workshop series. Depending on funding, the second workshop (biopower) and the third (bioproducts) will be held at a time yet to be determined.

3.0 Results of Activities

Project activities contributed to the realization of the project goal of identifying near-term research opportunities that Oregon BEST could invest in to promote Oregon's rural economy through two components: developing a biobased products capabilities inventory reaching across the Oregon University System, and carrying out workshops in three rural areas of the state targeting private- and public-sector individuals and entities with knowledge of, and interest in, biobased products.

3.1 Component 1: OUS Biobased Products Capabilities Inventory

Developing the faculty capabilities database helps achieve the project goal by identifying those researchers within a large, disaggregated research community who may be interested in helping develop biobased products. Through this exercise we were able to identify 21 OUS faculty with research interests in biobased products who are currently not members of the Oregon BEST faculty. Response rate was moderate as of the date of this report; however, the list is one which will need to be updated over time. If and when that occurs, there may be additional opportunities to contact researchers who did not respond to the current round of inquiries.

3.2 Component 2: Outreach to Rural Communities

The rural community outreach component helped achieve the project goal by:

- screening participants for invitation-only outreach events to ensure that those who attended were active in existing or planned businesses and who therefore had knowledge of biobased product development;
- holding the outreach events in rural communities and limiting attendance to those from rural communities;
- bringing together interests across multiple counties in each instance to broaden presenters' information dissemination and encourage networking and information sharing among participants;
- developing presentations for each workshop to help participants gain up-to-date information on policies, programs and research aimed at helping rural Oregon residents create biobased product businesses;
- holding an 'open session' following the presentation portion at each workshop, ensuring that anyone with questions, issues or information was heard by the entire

group and providing the opportunity for workshop participants as well as presenters to answer questions and share perspectives;

- tailoring the afternoon session at each workshop to meet group needs and experiment with information strategies. In each instance, facilitators asked the group for suggestions and for consensus on what approach to take. In Klamath Falls, the afternoon session involved setting up tables as 'mini open house' locations by topic. In Tillamook, facilitators had groups break out by product interest area. In Pendleton, group participants opted to remain as a large group for the afternoon session; and
- asking participants specifically what research was needed to help shift biobased products from ideas to functioning businesses.

3.3 Results of the Outreach Events

Two distinct sets of needs emerged from the outreach events. One was, of course, research needs, as that was the stated workshop objective in all instances. However, at each workshop, important non-research issues came up as well. Together, they provide a snapshot of how BEST, and Oregon, can move forward to help support rural economic opportunities through biobased product development.

Table 2 presents a list of the interests expressed across the three workshops. While it provides an overall snapshot of interest in various biobased products, it needs to be read with some cautions, which also explains why numbers in each category were not supplied. In certain instances, it may be that people representing various interests were not identified and invited to a workshop in a given location. In other instances, particular interests may have been invited but either declined the invitation or indicated they would participate and, for whatever reason, did not attend.

PRODUCT	KLAMATH FALLS	TILLAMOOK	PENDLETON
ALGAE	X		
BIOBASED BY-PRODUCTS			X
BIOCHAR	X		X
BIODIESEL			X
BIOMASS – ANYTHING ECONOMICALLY FEASIBLE	X		
BIOMASS FOR ELECTRICITY / CO-GENERATION	X	X	X
BIODIGESTION		X	X
BRIQUETTES			X
CELLULOSIC FUELS	X		X
GEOHERMAL	X		
OILSEED CROPS	X		X
NEW PRODUCTS UTILIZING SOLID WASTE		X	
WOOD FIBER AS NON-RENEWABLE MATERIALS SUBSTITUTE		X	

Table 2: Biobased Products Interests

3.3.1 Research Needs

Insights into research needs came from answers to the research related questions the facilitators asked at the workshops, from responses to presentations, and from the morning open sessions and afternoon sessions. Research needs generally fall into two categories: science and technology.

Science

- More information is needed regarding what feedstocks are suitable for use (e.g., whether there are any potential problems using invasive species).
- There is a need for more data regarding whether various products and potential byproducts involve risks such as toxicity.
- Sound science is needed to help resolve questions about products that might otherwise be limited by regulation that would dampen investment incentives.
- More information and research is needed regarding how to utilize geothermal energy to grow algae.
- There is also a need for more research on creating biobased products from algae.
- “Right” product selection is difficult without knowing the full range of possible products. Having a comprehensive inventory of potential biobased resources would help identify possibilities and focus efforts.
- Not all possible products appear to have been explored. For instance, there is potential for use of damaged agricultural crops such as moldy grain that are not suitable for primary markets; however, there doesn’t seem to be much information on the topic.
- It is important to know the carrying capacity of lands that supply feedstock in order to ensure a steady stream of inventory.
- More research is needed to answer questions about how much biomass can be removed from forests without affecting soil composition and fertility. A Tillamook participant noted that there is currently very little data on coastal soils that could help resolve that issue.
- Data is needed regarding the rate at which biochar can and/or should be added to different soils to sequester carbon and to reduce the need for other fertilizers.
- Since juniper is both an invasive species and a plentiful potential feedstock, any research that leads to juniper use as a biobased product feedstock would be extremely helpful.
- For juniper removal in range restoration projects, there is little or no data regarding the environmental effects of juniper yarding.
- More research is needed regarding the use of woody biomass as a substitute for fossil-fuel based materials in a variety of products.

In addition to the foregoing, more specific issues, a participant summed up the role of science by stating that having reliable science confirming a product’s viability is critical before any business plan moves forward. He suggested that expert review teams that could advise individuals and communities about whether project design includes the correct and/or most current economic and technical calculations in order to reduce the potential for wasted time and poor project outcomes would be extremely helpful. There needs to be a way to more easily link potential businesses to researchers who can help them find

and incorporate science for product design. Many people have ideas but lack the scientific knowledge to further develop those ideas or evaluate the applicable science.

Technology

- More information is needed on 'best technology' for pyrolysis.
- There is interest in equipment that can generate energy to run in remote locations. There is also a need for equipment that can be used on steep slopes in order to recover more woody biomass.
- There is a need for credible information on what technologies and equipment have been most successful in a given field of interest.
- In addition to knowing what technologies have been most successful, there is a need for information on the most successful (best) practices to use with those technologies.
- Technology for on-property biofuel production for individual use would be helpful even if it didn't lead to additional job creation. There is, however, potential for individual users to create co-ops and sell biofuels, which could lead to job creation.
- More research is needed regarding technology that can help biodigesters work with multiple feedstocks.
- More information on how to combine biobased technologies to develop byproducts from primary products (for example, protein for animal feed or pharmaceutical grade glycerin as byproducts from crops for biofuels) would improve business planning.

When asked whether they would be interested in being involved in collaborative research, many participants indicated they would be interested without being specific. For those indicating specific interests, the following are some of the suggestions:

- determining which alternative crops would give an economic return to supply feedstocks for bioenergy in order to increase interest and incentives among agricultural producers;
- research in combining feedstocks (e.g., grass seed straw with non-chlorine plastic and wood chips) for various products;
- locating landowners who might be interested in participating in various types of research;
- testing and certification of natural soil amendments for export to Europe and Asia; and
- biochar testing on farm soils.

3.3.2 Non-Research Needs

Many non-research issues surfaced across the outreach events. People involved in biobased product development have a pronounced need for various types of data in addition to credible scientific and technical information. This suggests a significant role for Oregon BEST and for the Oregon University System to help reduce uncertainty for potential businesses. While the following issues are not research oriented and are therefore beyond the outreach event objectives, they are linked to development capacity and may therefore help Oregon BEST consider how to deliver research resources to help Oregon's rural communities.

Policy/Incentives

- The state needs to ensure that its incentives, such as energy tax credits, are effective and useful.
- There should be better incentives to increase farmers' interest and reduce risks for trying new crops for biobased feedstocks.
- There need to be better financial incentives from utilities for production of excess energy from biobased sources that can be purchased to supply the energy grid.
- Current U.S. Forest Service policies create high uncertainty for woody biomass businesses: the Forest Service needs to streamline the NEPA process and develop and maintain NEPA approved supply that stays ahead of demand and thereby provides reliable inventory.
- Federal stewardship contract timelines need to match amortization schedules to reduce uncertainty.
- Tax incentives are meant to increase the use of replacement materials in pavement, but the policy is unclear or not well known in various communities.
- Carbon credits, stewardship contracts and other programs can increase innovation with respect to woody biomass; however, Oregon landowners are subject to Oregon Forest Act requirements for forest practices that limit forest owners' ability to qualify for carbon credits.
- Oregon needs to create policies and programs that make the state attractive for biobased product businesses.
- Existing federal and state agencies that provide funding are difficult to tap into, especially for those who are inexperienced.
- Oregon needs policies that either direct or encourage state facilities to explore more biobased energy alternatives when replacing energy systems.

Education/Communication

- The state can help strengthen demand for biobased products and related policies through a public education campaign.
- Communication and education are important to help agricultural interests identify possibilities for individual use and business opportunities.

Infrastructure, Capacity and Planning

- Information infrastructure is needed: the state should create a readily accessible clearinghouse of technology and best practices information.
- Developing projects and industry clusters are capacity issues that require systems approaches: finding reliable information, carrying out feasibility studies, and developing infrastructure and institutions to promote and sustain businesses.
- It is difficult to extrapolate from development information that is written for areas such as the Midwest what the appropriate and viable scale for biobased products would be for Oregon in the context of existing or potential infrastructure.
- Counties need to develop strategic plans, perhaps in collaboration with other counties, to help create capacity.
- Oregon is losing its logging infrastructure, which affects statewide capacity for woody biomass sector development.

- Good transportation infrastructure is needed to reduce production costs.
- Oregon needs to conduct a county-by-county inventory of biobased product possibilities in order to help create regional and sectoral networks that will enhance business viability.
- Many communities/counties don't have the initial funding, expertise or human resources to develop projects. It would be helpful to have a program dedicated to bringing together the funding and the scientific, economic and technical expertise to help communities and counties get started.

Funding

- Project and planning funding are still the biggest challenges to development.
- Most successful funding has been for individual project development; however, businesses and communities should be thinking in terms of industry development and clustering.
- Funding proposals involving collaboration between the private sector and academia will be more competitive than proposals coming from either sector individually.

Cluster Development

- Transportation costs constrain business development; industry clusters and regional development might reduce transportation cost constraints.
- New organizational structures will be necessary for cluster development and general business support.
- Relationships need to be established and maintained among biobased products interests to enhance business prospects individually and as an industry cluster.

Additional Information and Research

- Potential businesses need data and a way to verify its integrity. The field is rife with unproven and differing claims, and it can be difficult and costly to determine what is legitimate.
- People would like to know more about the estimated time between potential and market readiness for various products based on current research.
- It would be helpful if there were good economic models. For instance, for woody biomass utilization, is it better to transport materials or process them onsite?
- There needs to be a way to facilitate contact between product developers and researchers.
- Communities and businesses need access to a single, in-state, interactive site where they can find out who is doing what, post questions and share information.

3.3.3 Additional Outcomes

People at the workshops appreciated the highly interactive design and were able to take advantage of it. One participant offered that the workshop was a good opportunity to renew acquaintances and to explore new possibilities with people from different locations. An Oregon BEST press release provided an example:

"I've attended 12 conferences of this kind, both here in Oregon and in other parts of the country, and this one hosted by Oregon BEST was by far the best I've ever been to," said Joseph Laurance, Douglas County Commissioner. "The speakers were absolutely top notch, and I came away with a concrete funding opportunity that could enable Douglas County to purchase a \$350,000 piece of mobile equipment that converts biomass at logging sites into the right type of chips for biofuels and biochar.

-- Oregon BEST Press Release, February 12, 2009

Another participant talked about the high value of the workshops as state development activities are often centered on the interstate corridors, leaving out many of the more isolated communities.

In another instance, a participant gained new information on a potential product from other businesses with more experience as well as from presenters.

At all of the workshops, people were very engaged in all of the topics covered by the different presentations. Many became familiar with organizations such as Oregon Solutions for the first time and with the types of biobased related research being carried out in Oregon and at the Pacific Northwest National Laboratory in Richland, Washington.

3.4 Recommendations to Oregon BEST

Based on activities and responses at the three workshops, Oregon BEST may want to pursue any or all of the following options for near-term research investment:

- Research that specifically supports regional cluster development. This will require developing an inventory of existing and potential businesses as well as an inventory of biobased resources to support businesses in each region. It was clear from the workshops that helping businesses develop a network will help establish and support individual businesses and regional sectors.
- Research investments based on product interest and potential. There was strong interest in various uses for woody biomass in each of the workshops. Most of the interest was in using woody biomass for energy production. Particularly in south-central and north-northeast counties, people are interested in any research that can yield useable products from juniper. Since juniper removal is also a component of range recovery, there is high incentive for business development utilizing juniper.
- Research that drives new product opportunities and acceptance. Briquettes as a woody biomass product were not discussed until the Pendleton workshop. Given its potential for overseas markets as well as for domestic use, and since its manufacture may be less complicated than other wood based fuel products, research that helps create mobile production technology could help rural areas. Another research area might be the use of invasive species such as Scotch Broom, English Hawthorne or knapweed as biobased products feedstock.
- Create a list of researchers who would be willing to serve as expert review team members. The expert review teams would advise individuals and communities about whether project design includes the correct and/or most current economic and technical calculations in order to better ensure product viability. This would have the added advantage of providing researchers with the opportunity to see

what products interest people which might stimulate additional ideas for research and funding.

Mark Kendall, Senior Policy Analyst for the Oregon Department of Energy (Oregon DOE), prepared the following list of needed policy and actions with regard to biomass as part of a slide presentation. It is being reproduced here to provide further consideration regarding near-term research investments as most of the items listed are consistent with interests expressed at the workshops.

What's Called for Now in Biomass

- Particulate matter emissions controls for small boilers
- Efficient dryers for 10K ton per year processing
- Analysis of agriculture fertilizer price elasticity
- Biochar and bio oil applications/refining
- Cellulosic fuels production with Oregon crops
- Small diameter, brush collection in forest
- In-situ, real-time soil health monitors
- Carbon dioxide reduction from fire risk reduction
- Analysis of small-diameter merchandising yards
- Automation of institutional boiler applications
- Digital digester template
- Feedstock pre-treatment inventory for cellulosic
- Wastewater biosolids land application science
- Small confined animal feeding manure solutions
- Ammonia recovery/conversion for fertilizer
- Closed loop, net zero energy farming models
- Corn ethanol cellulosic conversion econometrics
- Urban green waste best practices identified
- Municipal solid waste organics mining methods
- Community scale inventories and action plans
- Statewide, one map, GIS of all biomass resources
- Field trials of more seed oil and cellulose crops
- More value added uses of fiber and small diameter
- Inventory of forest and agriculture human resources
- Integrate energy use of biomass in local economies
- Succession planning for agricultural and forest ownership
- Bio products refinery analysis and design
- And the list goes on...

Interests and challenges identified at the workshops, combined with Oregon DOE policy and action recommendations, indicate that Oregon BEST's outreach to rural communities has helped provide much needed information, has identified a broad range of research opportunities, and has started to build the awareness and networks among rural businesses and communities necessary to help Oregon link its objective of moving toward

renewable energies to a long-standing state objective of revitalizing and supporting rural communities.

4.0 Project Organization and Management

4.1 Anticipated or Unanticipated Events

As mentioned in Section 2.3, Component 3 of the project (a biobased product symposium), we opted out of an independent, Oregon BEST biobased products symposium due to other biobased conferences and meeting being organized around the state during the same timeframe.

4.2 Project Financial Report

The financial report will come under separate cover.

4.3 Copies of Publications

Copies of this report will be made available in electronic format to workshop participants via downloading from the Oregon BEST website: www.oregonbest.org.

Appendix A



March 6, 2009

Greetings Colleagues:

On behalf of the Oregon Built Environment & Sustainable Technologies Center (Oregon BEST), the Institute for Natural Resources (INR) would like to invite you to a workshop: *Oregon Biobased Products for Rural Economic Development*. The workshop will be held Thursday, April 2 from 8:00AM to 2:00PM at the Oregon Department of Forestry office in Tillamook. Lunch and refreshments will be served. At this workshop you will be joining a group of people representing different sectors around your region.

Sponsored by Oregon BEST and endorsed by the Tillamook Futures Council, Tillamook County, the Port of Tillamook, Oregon State Extension Service and Oregon Solutions, the purpose of this invitation-only workshop is to be an information-sharing forum that helps identify near-term research opportunities that Oregon BEST could invest in to promote Oregon's rural economy. Put into place by the Oregon Legislature, Oregon BEST is a collaborative enterprise among Oregon University System institutes to investigate various topics "relevant to the development of, and gradual transition to, renewable resources." To this end, the workshop is designed to:

- inform participants of the status and potential of biobased resources and products in their region, biobased products policy support, and the potential links to rural economic development;
- have participants share knowledge and identify local biobased product opportunities and preferences, local barriers and incentives to participating in biobased product markets, and applied research opportunities that could leverage local biobased product efforts; and
- craft and prioritize locally-based economic development opportunities that build on specific biobased products

You have been recommended to participate in this workshop; however, we don't expect you to be an expert on biobased products, which are renewable goods comprised mainly of plant or animal materials and include wood innovation, natural-based product substitution in manufactured products, biomass produced energy, algae, and wood-related manufacturing for green building, among others.

If you can participate, RSVP to Sue Lurie at (541) 737-9919 or by email to sue.lurie@oregonstate.edu no later than close of business March 18 and we will send you additional materials regarding the workshop. In the event that you have questions, one of our project staff will follow up with you by telephone.

We look forward to hearing from you and hope you will be able to participate in this exciting event.

Sincerely,

Sue Lurie and Lisa Gaines
Institute for Natural Resources
Oregon State University
210 Strand Agriculture Hall
Corvallis, OR 97331-2208
Phone: (541) 737-9919
Fax: (541) 737-1887
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David Kenney
Oregon BEST
<http://oregonbest.org/>



Appendix B



Bio-based Products and Economic Development Workshop

Klamath Falls, OR – January 30, 2009

MT. MAZAMA ROOM, COLLEGE UNION BUILDING
OREGON INSTITUTE OF TECHNOLOGY, KLAMATH FALLS CAMPUS

SCHEDULE	AGENDA ITEM
8:30 – 9:00 30 MINUTES	CHECK-IN
9:00 – 9:20 20 MINUTES	WELCOME AND OVERVIEW Brief overview of BEST, the project, the workshop, and anticipated project and workshop outcomes <i>Institute for Natural Resources, OSU; Oregon BEST Center</i>
9:20 – 9:45 25 MINUTES	PRESENTATION: POLICY SUPPORT FOR BIO-BASED PRODUCTS <i>Mark Kendall, Oregon Department of Energy</i>
9:45 – 10:35 50 MINUTES	PRESENTATION: LOCAL ECONOMIC DEVELOPMENT – BIO-BASED RESOURCES AS BRIDGE TO ECONOMIC DEVELOPMENT <i>Betty Riley, South Central Oregon Economic Development District, Wendy Willis, Oregon Solutions</i>
10:35 – 10:45 10 MINUTES	BREAK
10:45 – 11:15 30 MINUTES	PRESENTATION: EXAMPLES OF APPLIED RESEARCH FOR ENHANCING BIO-BASED PRODUCTS CAPACITY AND ECONOMIC DEVELOPMENT <i>Christine Kelly, Oregon State University</i>
11:15 – 12:00 45 MINUTES	OPEN SESSION Open exchange among participants and presenters regarding bio-based products for rural economic development
11:45 – 12:30 45 MINUTES	LUNCH
12:30 – 1:30 60 MINUTES	SMALL GROUP SESSION: CRAFTING INITIAL BIO-BASED PRODUCTS STRATEGIES AND PRIORITIZING ECONOMIC DEVELOPMENT/RESEARCH OPPORTUNITIES Participants will break out into groups to identify potential economic strategies and research needs BEST can pursue to help with those strategies
1:30 – 2:00 30 MINUTES	RE-GROUP: THE BIG IDEAS AND WHAT NEXT Break-out groups report out to larger group
2:00	ADJOURN

Facilitated by



Endorsed by South Central Oregon
Economic Development District, Collins
Pine Company, and Oregon Solutions



**Bio-based Products for Rural
Economic Development Workshop**
Tillamook, OR – April 2, 2009

TILLAMOOK DISTRICT CONFERENCE ROOM
OREGON DEPARTMENT OF FORESTRY

SCHEDULE	AGENDA ITEM
8:00 – 8:30 30 MINUTES	CHECK-IN
8:30 – 8:50 20 MINUTES	WELCOME AND OVERVIEW Brief overview of anticipated workshop outcomes and the Oregon BEST Center <i>Institute for Natural Resources, OSU; Oregon BEST Center</i>
8:50 – 9:30 40 MINUTES	PRESENTATION: POLICY SUPPORT FOR BIO-BASED PRODUCTS <i>Mark Kendall, Oregon Department of Energy</i>
9:30 – 9:50 20 MINUTES	PRESENTATION: LOCAL ECONOMIC DEVELOPMENT – BIO-BASED RESOURCES AS A BRIDGE TO ECONOMIC DEVELOPMENT <i>Wendy Willis, Oregon Solutions</i>
9:50-10:00 10 MINUTES	BREAK
10:00 – 11:00 60 MINUTES	PRESENTATION: EXAMPLES OF APPLIED RESEARCH FOR ENHANCING BIO-BASED PRODUCTS CAPACITY AND ECONOMIC DEVELOPMENT <i>Ken Williamson and Lech Muszyński, Oregon State University</i>
11:00-12:00 60 MINUTES	OPEN SESSION Open exchange among participants and presenters to ask questions and share information and ideas
12:00 – 12:40 40 MINUTES	LUNCH
12:40 – 1:30 50 MINUTES	SMALL GROUP SESSION: CRAFTING INITIAL BIO-BASED PRODUCTS STRATEGIES AND PRIORITIZING RESEARCH AND ECONOMIC DEVELOPMENT OPPORTUNITIES
1:30 – 2:00 30 MINUTES	RE-GROUP: THE BIG IDEAS AND WHAT NEXT Break-out groups report out to larger group.
2:00	ADJOURN

Facilitated by



Endorsed by Tillamook Futures Council,
Port of Tillamook, Tillamook County,
Oregon Solutions and Oregon State
University Extension Service



Bio-based Products for Rural Economic Development Workshop

Pendleton, OR – April 7, 2009

UMATILLA HALL, ROOM 100
BLUE MOUNTAIN COMMUNITY COLLEGE

SCHEDULE	AGENDA ITEM
8:00 – 8:30 30 MINUTES	CHECK-IN
8:30 – 8:50 20 MINUTES	WELCOME AND OVERVIEW Brief overview of anticipated workshop outcomes and the Oregon BEST Center <i>Institute for Natural Resources, OSU</i>
8:50 – 9:30 40 MINUTES	PRESENTATION: POLICY SUPPORT FOR BIO-BASED PRODUCTS <i>Diane Henkels, Oregon Department of Energy</i>
9:30 – 9:50 20 MINUTES	PRESENTATION: LOCAL ECONOMIC DEVELOPMENT – BIO-BASED RESOURCES AS A BRIDGE TO ECONOMIC DEVELOPMENT <i>Wendy Willis, Oregon Solutions</i>
9:50-10:00 10 MINUTES	BREAK
10:00 – 11:30 90 MINUTES	PRESENTATION: EXAMPLES OF APPLIED RESEARCH FOR ENHANCING BIO-BASED PRODUCTS CAPACITY AND ECONOMIC DEVELOPMENT <i>Don Wysocki, Oregon State University</i> <i>Christine Kelly, Oregon State University</i> <i>Don Stevens, Pacific Northwest National Laboratory</i>
11:30 -12:45 75 MINUTES	OPEN SESSION / LUNCH Open exchange among participants and presenters to ask questions and share information and ideas
12:45 – 1:30 45 MINUTES	SMALL GROUP SESSION: CRAFTING INITIAL BIO-BASED PRODUCTS STRATEGIES AND PRIORITIZING RESEARCH AND ECONOMIC DEVELOPMENT OPPORTUNITIES
1:30 – 2:00 30 MINUTES	RE-GROUP: THE BIG IDEAS AND WHAT NEXT Break-out groups report out to larger group.
2:00	ADJOURN

Facilitated by



Endorsed by Greenwood Boardman
Tree Farm, The Collins Companies,
Greater Eastern Oregon Development
Corporation and Oregon Solutions

Appendix C

AN ECONOMIC ENGINE FOR OREGON

An independent, nonprofit organization established by the Oregon Legislature in 2007, the Oregon Built Environment & Sustainable Technologies Center (Oregon BEST) builds on the state's reputation as a national innovator in sustainability, natural resources, and renewable energy.

Our mission is to grow and focus a shared, statewide network of university researchers, laboratories, and equipment in the following two strategic areas:

- **Green Building Products and Services**
- **Renewable Energy Generation**

Powered by university research, industry collaboration, and commercialization, Oregon BEST ensures Oregon is a global leader in the emerging green economy. Our charter is to make Oregon businesses globally competitive by transforming and commercializing university research into new companies, services, products, and jobs that fuel Oregon's economy.



HISTORY & FOUNDING UNIVERSITIES

Oregon BEST was established as an independent, nonprofit organization in 2007 as part of the Oregon Innovation Council's legislative recommendations. Initial funding came from the Oregon Legislature, with additional support from the Oregon University System and the Meyer Memorial Trust. Our partner universities include the Oregon Institute of Technology, Oregon State University, Portland State University, and the University of Oregon.



BLENDING RESEARCH & BUSINESS: A POWERFUL CATALYST FOR OREGON'S GREEN ECONOMY

An economic development catalyst, Oregon BEST connects the state's business community with its shared network of university researchers and laboratories to grow Oregon's green building and renewable energy sectors. This collaborative blend of research and industry adds value and en-

hances competitiveness for existing Oregon businesses, increases state revenues, improves university research, and helps Oregon recruit new green companies.

By creating a shared, statewide R&D network for renewable energy and green building, people all across Oregon benefit — from architects and construction firms engaged in green building design, to farmers and forest products companies producing biomass for clean fuels and bioproducts, to large and small companies generating solar, wind, geothermal, and wave energy.

Oregon BEST helps attract research dollars to Oregon universities from federal agencies, foundations, and private companies by strategically investing in key research projects and facilities that can leverage additional funding and create economic impact.

Oregon BEST
PO Box 212
Portland, OR
97207-0212
phone 503/725-9849

Appendix D



**Institute
for
Natural
Resources**

Helping Address Oregon's Natural Resource Concerns

Created by the Oregon Legislature as part of the 2001 Oregon Sustainability Act, INR is a cooperative enterprise that acts as a catalyst by bringing together decision-makers and researchers from the Oregon University System to address complex, interdisciplinary natural resource issues. Rather than duplicating on-going work or replacing the functions of existing organizations, INR builds links between information producers and information users.

Oregon State University
210 Strand Agriculture Hall
Corvallis, Oregon 97331-2208
(541) 737-9918
<http://inr.oregonstate.edu>

Our Mission

The Institute for Natural Resources provides Oregonians with ready access to current, relevant science-based information, methods, and tools for better understanding natural resource management challenges and developing solutions.

Information Program

The INR Information Program seeks to integrate and improve access to comprehensive information, tools, and expertise related to natural resource management in Oregon.

The **Oregon Natural Heritage Information Center** houses Oregon's most comprehensive database of rare, threatened, and endangered species-including site-specific information on the occurrences, biology, and status of over 2,000 species throughout Oregon. It includes the state's only database of natural vegetation, with descriptions and information on the occurrences and protected locations of all known ecosystem types. Agencies, companies and individuals can access this information by submitting a detailed written request to ORNHIC.

The **Oregon Explorer** is a collaborative project between OSU Libraries and the INR. It provides internet access to integrated natural resources information with content both onsite and offsite, place-based, where most information is geo-referenced, with value-free, neutral information, maintained over the long-term.

Policy Research Program

The INR Policy Research Program brings the capacities of Oregon University System to Oregonians who need policy analysis, research, and evaluation about complex, interdisciplinary natural resource issues. INR seeks to *anticipate* and *clarify* natural resource issues of concern, to help policymakers avoid operating in crisis mode. We seek to develop, test, and implement new policymaking methods and tools, and to improve on existing alternatives by looking at issues from different angles—an aim that can be transformative and useful to natural resource decision-making. INR also strives to demonstrate that its research and communications are policy neutral.



Appendix E

GLOSSARY

The following few terms regarding biobased products are excerpted from:

The Biomass Research and Development Board. (2001.) *Fostering the Bioeconomic Revolution in Biobased Products and Bioenergy* Washington, DC: The Biomass Research and Development Board.

The full glossary is available at
<http://www1.eere.energy.gov/biomass/pdfs/28950.pdf>

biobased products: commercial or industrial products, other than food and feed, derived from biomass feedstocks. Biobased products include green chemicals, renewable plastics, natural fibers, and natural structural materials. Many of these products possess unique properties unmatched by petroleum-based products or can replace products and materials traditionally derived from petrochemicals. However, new and improved processing technologies will be required.

bioenergy: the energy contained in material produced by photosynthesis (including organic waste) may be used directly or indirectly to manufacture fuels and substitutes for petrochemicals and other energy-intensive products. The production of energy from biomass, for example, can be direct (e.g., via combustion) or indirect (e.g., via conversion into ethanol or through gasification).

biofuels: fuels made from biomass resources, including the liquid fuels ethanol, methanol, biodiesel, Fischer-Tropsch diesel, and gaseous fuels such as hydrogen and methane. Conversion of biomass to fuels generally involves conversion to an intermediate (sugar or syngas) and then to a fuel by a catalyst.

biomass: organic matter available on a renewable basis. Biomass includes forest and mill residues, agricultural crops and residues, wood and wood residues, animal wastes, livestock operation residues, aquatic plants, fast-growing trees and plants, and the organic portion of municipal and relevant industrial wastes.

biopower: the use of biomass feedstock to produce electric power, through direct combustion of the feedstock, through gasification and then combustion of the resultant gas, or through other thermal conversion processes. Power is generated with engines, turbines, fuel cells, or other equipment.

Appendix F

OREGON'S BIOMASS ENERGY RESOURCES

The following is excerpted from the Oregon Department of Energy website:
<http://www.oregon.gov/ENERGY/RENEW/Biomass/resource.shtml>

Wood

There are three primary sources of woody biomass in Oregon. Wood products residue is the wood waste generated at Oregon sawmills and wood products mills. Forest biomass is residual biomass material generated from logging or thinning activities on forests in Oregon. Urban wood waste includes discarded wood and yard debris. In addition, hybrid poplar plantations in Oregon represent a small woody biomass resource for energy production.

The Department of Energy estimates that these sources generate approximately 12.7 million bone dry tons of woody biomass on an annual basis, but not all of the woody biomass resource is available for energy uses due to the cost of collecting and transporting the materials and other factors. The available woody biomass resource may be as much as 9.8 million bone dry tons.

Much of the available resource is currently used. About 67 percent of the available resource is used for purposes other than energy production. The primary use is in the pulp and paper industry. About 26 percent of the available resource is already used for energy production. This amounts to about 2.5 million bone dry tons annually. The energy value of this resource amounts to about 43 trillion Btu.

About 7 percent of the available resource is not being used for either energy production or other purposes. This resource amounts to about 0.7 million bone dry tons of woody biomass on an annual basis. This resource is potentially available for energy production and has a gross energy value of approximately 12 trillion Btu.

Wood Products Residue

Wood products residue is a byproduct of timber milling and wood products manufacturing. Sawmills convert harvested timber into wood products through debarking, chipping, sawing, peeling, planing, shaving, trimming and sanding. Sawmills process logs into lumber, veneer and plywood. Other wood products mills and factories process wood into manufactured goods, such as furniture, cabinets, containers and pallets. Residue from the wood products industry includes trim, planer shavings, sawdust and bark.

Lower-quality mill waste is put through a grinding machine (called a "hog") and is used for fuel. "Hogged fuel" is a convenient fuel supply for boilers and electric power generation at mills that produce the material. The moisture content of hogged fuel is about 50 percent. Its energy content is 4,500 Btu per pound. It has a bulk density of 16 to 22 pounds per cubic foot.

Modern and efficient manufacturing processes at Oregon mills have resulted in less wood waste. Some of the waste is of high quality and is suitable for use in the pulp

and paper industry. New composite wood products made from residual materials have further reduced the amount of wood products residue available for energy production.

Forest Biomass

Tree tops, limbs and cull material left over from logging activity represents a large potential resource for biomass energy. Forest biomass has a bulk density of 18 to 22 pounds per cubic foot and a typical moisture content of 50 percent. It has an energy value of 4,500 Btu per pound. Timber harvest variability and uncertain market conditions make long-term supplies of forest biomass from logging operations unpredictable.

Nevertheless, the potential energy resource is large. The Department of Energy estimates that 3.3 million bone dry tons of forest biomass residue was generated from timber harvest activity in 2004. An estimated 0.63 million bone dry tons of forest biomass was economically available to be used for energy production. The available forest biomass resource had an energy value of 10.8 trillion Btu.

Leaving some dead wood in the forest is good for forest ecosystems. Standing snags and dead wood on the forest floor provide habitat for wildlife. Woody debris on the ground deters erosion and, by its decomposition, helps maintain soil fertility and tilth. Although dead trees and woody debris play an important role in forest ecosystems, excessive accumulation of forest biomass becomes a threat to the health of live trees by making the forest susceptible to disease, insect infestations and high-intensity forest fires.

Reduced timber harvest activity and suppression of forest fires have caused an unnatural surplus of dead wood in many Oregon forests. Selective thinning in these areas could remove the excess biomass that poses a risk to sustainable forests.

According to Western Forest Health and Biomass Energy Potential, a study prepared for the Oregon Department of Energy, the cost to the public for fighting forest fires averages about \$216 per acre. However, the cost of a thinning operation ranges from \$50 to \$150 per acre. The cost of thinning varies and depends largely on the location and topography of the site and the type of equipment used.

Urban Wood Waste

A significant amount of wood is discarded from individual households, commercial businesses, and construction and demolition sites. Urban wood waste includes lumber, pallets, crates, discarded wood furniture and other wood products. Yard debris contains additional wood waste in the form of tree and brush prunings, limbs, trunks and stumps.

Manufacturers of composite wood products can use clean, high quality urban wood waste in products such as flakeboard, oriented strandboard, particleboard and fiberboard. Pulp mills can convert clean wood waste into paper products. Urban and industrial wood waste that is not suitable for higher-value products has value as hogged fuel or compost.

The Oregon Department of Energy estimates that Oregonians discarded 0.56 million bone dry tons of urban wood waste in 2004. Approximately 0.32 million bone dry tons of wood was recovered from the waste stream. Much of the wood recovered from the waste stream was used for energy production. About 0.19 million bone dry tons of recovered urban wood waste was used for energy. This resource had a gross energy value of about 3 trillion Btu.

By increasing the rate of recovery of urban wood waste, an additional 14,000 bone dry tons of urban wood waste could be kept out of landfills. This amount of available wood waste has a gross energy value of about 0.24 trillion Btu.

Hybrid Poplar Plantations

There are more than 34,000 acres of hybrid poplar (cottonwood) trees growing on plantations in Oregon. The trees were originally planted to be a source of wood fiber for the pulp and paper industry, but some of the plantations will be harvested for lumber.

Although commonly called "hybrid poplar," the plantation trees grown in Oregon are a cross between black cottonwood and Eastern cottonwood. The hybrid is a fast-growing tree that thrives in the Pacific Northwest. Properly managed hybrid cottonwood plantations are ready for harvest six to eight years after cuttings are planted. At harvest, 70 to 80 percent of the biomass in each tree is suitable for pulp.

The U.S. Department of Energy anticipates that dedicated feedstock supply systems, including cultivation of short-rotation woody crops such as hybrid poplar, will be a major fuel source for the biomass power industry in the future. Harvest of these trees for pulp chips produces a biomass residue of bark, leaves and stumps that are usable for fuel. Residue yield varies depending on the hybrid variety, management practices and the age of the stand at the time of harvest as well as weather and other environmental factors. Residue yield ranges from 7 to 15 bone dry tons of fuel per acre. Thus, the gross energy value of the residue per 1,000 acres of harvested hybrid poplar ranges from 0.12 to 0.26 trillion Btu.

PULPING LIQUOR

The pulping process produces a waste stream of spent pulping liquor. Pulp mills burn the pulping liquor to recover and recycle the chemicals used in the pulping process. These chemical recovery boilers supply pulp mills with process steam. Two Oregon pulp mills use the boilers to cogenerate steam and electricity. The energy content of the pulping liquor consumed in Oregon in 2004 was approximately 35 trillion Btu.

The entire pulping liquor resource is already being used for energy in the form of steam and electricity. However, when older boilers reach the end of their operating life, there will be opportunities to install new, more efficient technology. There is a potential to add up to 57 average megawatts of generating capacity to those mills that do not currently produce electricity.

MUNICIPAL SOLID WASTE

Approximately 70 percent of the waste disposed of in landfills is biomass material, including food waste, waste paper, cardboard and wood waste. Municipal solid waste (MSW) has a moisture content of 30 to 40 percent and an energy content of about 4,500 Btu per pound. Its bulk density is 12 to 20 pounds per cubic foot.

Oregonians recycle or recover 37 percent of the MSW generated in the state, but every day, about 8,100 tons of MSW is dumped in landfills. In 1983, the Oregon Legislature established priorities for solid waste management, establishing a legislative policy that the use of solid waste for energy production should take precedence over landfill disposal.

In 2004, Oregonians disposed of an estimated 3.0 million tons of MSW in landfills. Of that, an estimated 70 percent could have value as an energy source. Excluding the Department of Energy's estimate of recoverable urban wood waste, the potential energy value of the MSW discarded in 2004 was approximately 18 trillion Btu. This amount of biomass could be used to generate 121 average megawatts of electricity.

BIOGAS

Wastewater Treatment

Anaerobic digesters reduce the organic content of wastewater and decrease the amount of sludge disposal required at wastewater treatment facilities. The biogas generated in the process is often used as boiler fuel to supply heat for the digesters and for other treatment facility uses. However, nine wastewater treatment facilities in the state also use the gas to produce electricity.

The Department of Energy estimates that, overall, as much as 36 percent of the biogas produced at Oregon's wastewater treatment facilities is unused. This surplus biogas is a potential energy source. In 2004, the unused gas had an energy value of approximately 0.3 trillion Btu. This amount of biogas could be converted to about 2 average megawatts of electricity.

Organic Waste Digesters

Manure from livestock on Oregon farms is a resource for the production of biogas through anaerobic digestion technology. Other organic wastes, such as agricultural and food-processing wastes, also could be used as digester feedstock. In local areas where there are many dairy farms, development of a centrally-located digester may be feasible.

The minimum size of dairy herd required to make a digester an economical investment for an individual farm depends on the local climate, the amount of manure collected, the type of technology used and the value of revenues from co-products and offsets. In general, large dairy operations (500 or more cows) may find it economically feasible to install a plug-flow digester.

In 2003, there were 111 dairies in the state that were licensed for herds of 500 or more cows. Based on the cumulative number of cows on-site at these dairies, the Department of Energy estimates that approximately 3,400 million cubic feet of biogas is potentially available annually through anaerobic digestion technology. This

amount of biogas would have an energy value of about 1.7 trillion Btu, which could produce up to 13 average megawatts of electricity.

LANDFILL GAS

Anaerobic digestion of organic materials in landfills produces landfill gas. The rate of landfill gas generation varies depending on moisture content, temperature, the quantity of organic matter in the waste and the depth and density of the landfill. In general, production of landfill gas begins six months to two years after the waste is deposited. Production increases until the landfill closure and then declines rapidly, although landfill gas production can continue for 10 years.

The US Environmental Protection Agency's Landfill Methane Outreach Program has identified five landfills in Oregon as "candidate" landfills for production of electricity from landfill gas. The EPA selected these candidate landfills based on national data sources rather than on-site evaluation. More detailed assessment would be needed to determine the economic feasibility of developing a power generating facility at any of the state's landfills.

Based on EPA estimates of landfill gas available at candidate landfills, about 4,600 million cubic feet of landfill gas is potentially available on an annual basis. The energy value of this quantity of landfill gas is about 2.3 trillion Btu. The available landfill gas could produce up to 22 average megawatts of electricity.

AGRICULTURAL RESIDUE

The harvest of field crops and grass seed generates a residue of straw, stalks and stubble. The average moisture content of agricultural residues is 15 percent and the average heat content is 7,500 Btu per pound. Bulk density of these wastes is low, ranging from 10 to 16 pounds per cubic foot. Due to the annual cycles of crop growth and harvest, the supply of agricultural residue is not constant throughout the year. After a few months of storage, agricultural residue will begin to decompose and lose energy content.

The primary consideration in agriculture is maintaining the productivity of the soil where crops are grown. After harvest, crop residue has a vital role to play in controlling erosion from wind and water and in deterring runoff. A 30-percent covering of crop residue can reduce soil erosion from water and wind by 50 to 75 percent. Soil type and variations in slope length and steepness affect the amount of residue needed for control of water erosion. Crop residue reincorporated into the soil helps maintain soil carbon and nutrients and improves soil tilth and porosity. For these reasons, the amount of agricultural residue available as a biomass energy resource is limited to the residue that is not needed to maintain soil productivity.

The amount of biomass economically available from agricultural residues cannot be estimated with much precision. There are many varieties of agricultural products grown in Oregon and annual variations in yield. Weather, soil type, fertility, topography and cultivation practices affect the quantity of agricultural residues generated and available. To approximate the magnitude of the resource, the Oregon Department of Energy estimated the available residue from winter wheat and grass seed production.

In 2003, approximately 1.5 million dry tons of agricultural residue was available from farming activities in Oregon. The energy content of this resource was about 27 trillion Btu. This amount of agricultural residue could be converted into approximately 213 average megawatts of electricity.

SUMMARY OF BIOMASS RESOURCES

Resources	Quantity Available (2004)	Energy Value (TBtu)	Potential Electric Generation (average megawatts)
Wood	0.7 million bdt	12	96
Pulping Liquor	2.0 million bdt	25	57
MSW	1.3 million bdt	18	121
Wastewater Treatment	460 mcf	0.3	2
Organic Waste Digesters	3,400 mcf	1.7	13
Landfill Gas	4,600 mcf	2.3	22
Agricultural Residue	1.5 million bdt	27	213
Total		86.3	524

Appendix G

Workshop Topic One: Liquid Transportation Fuels

Ch2M Hill Alumni Center

Oregon State University, Corvallis, Oregon

June 29, 2009

AGENDA

- | | |
|-------------------------|---|
| 7:30 am | Registration and Coffee |
| 8:00 am | Welcome
Review Workshop Activities |
| 8:15 am
perspective: | Overview of bioproducts development from the life cycle analysis
<ul style="list-style-type: none">• Moderator: <u>Jan Auyong</u>, Sun Grant Western Regional Center• Panel: Ganti Murthy (OSU Biol. Ecological Engineering) and Christine Kelly (OSU School of Chemical, Biological & Environmental Engineering)• Engineering and economic approaches that cover, environmental, economic and social effects. |
| 9:00 am | Industry Perspectives on Biofuels: Where are we today?
<ul style="list-style-type: none">• Moderator: <u>Dave Smith</u> (OSU College of Forestry)• PanelE: Harrison Petit (PEI), Hiroshi (biodiesel)/___Summit, Beatty (Trillium)• Panel B: Tom Endicott (Pacific Biodiesel), Rico Cruz (Umatilla), Kent Madison (Madison Farms)• Panel Presentation: Overview of current hot topics and three things that researchers and state agencies could do that would be most helpful to industry |
| 10:30 am | BREAK |
| 11:00 am | Researcher Perspectives: Current hot topics and three things that industry and state agencies could do that would be most helpful to researchers
<ul style="list-style-type: none">• Moderator: <u>Thayne Dutson</u>, Sun Grant Western Regional Center• Panel: Christine Kelly (OSU School of Chemical, Biological & Environmental Engineering), Greg Rorrer (OSU School of Chemical, Biological & Environmental Engineering), Ganti Murthy (Biological & Ecological Engineering), Paul King (US Dept of Energy), Rico Cruz (Umatilla Confederated Tribes), David Hackleman (OSU School of Chemical, Biological & Environmental Engineering) |
| 11:50 am | State Agency and NonProfit Perspectives: What is the role of State in supporting and developing a biofuel industry in Oregon |

Appendix G

- Moderator: Chris Beatty, Trillium Biofuels
- Panel: tbd by Stephanie and Joe
 - Mark Kendall, Oregon Department of Energy and NGO's e.g., Energy Trust, Oregon Environmental Council, Northwest Environmental Biofuels Council, ODA, ODE, ODF

12:30 pm WORKING LUNCH (1 hour)
Exploring and creating opportunities

AFTERNOON SESSION: Participants Will Examine Aspects That Contribute To or Hinder The Commercialization Of Biofuels Production

- Small groups will concurrently look at specific issues for BioEthanol and Biodiesel, summarize their findings for posting to the Sun Grant website, and recommend a Roadmap strategy

1:30 pm Industry Panels present additional descriptions of experiences and roadblocks faced during commercialization.

- Moderator: Stephanie Page, Oregon Department of Agriculture
- Moderator: Joe Misek, Oregon Department of Forestry

2:15 pm Small Working Groups (5-10 people) convene to discuss issues and create a Draft Roadmap to present to the workshop. Groups should minimally address the following list of issues:

Topics to Discuss/Items to Address

1. Feedstock Production/Processing
2. Feedstock logistics (handling, storage, etc.)
3. Economics and Policy
4. Business Development
5. Financing, Capital Investment
6. Marketing and Distribution (Getting product to market)
7. Grants, programs, credits, and incentives
8. Consumer Education (addressing common public misconceptions)

3:30 pm BREAK

4:00 pm Return to Working Group

5:00 pm Comparison of proposed alternatives Roadmap development
Moderator: Lisa Gaines, Institute of Natural Resources

- Representatives from each working group will have 5-10 minutes to provide a brief overview of their discussion and present their Draft Roadmap
- Compare proposed roadmaps, prioritize strategies and activities
- Define next steps and collaborators
- Accessing workshop materials

6:15 pm SOCIAL with heavy appetizers for continued networking

Appendix G

7:30 pm ADJOURN

Registration fee covers breaks, lunch, and appetizers at social.

Planning Committee

Callie Carr
Jan Auyong
Chris Beatty
John Bolte
Mark Brady
Susan Capalbo
Chuck Carlson
Thayne Dutson
Thomas Endicott
Lisa Gaines
Ian Hill
William Jaeger
Russell Karow
Loren D.Kellogg
Christine Kelly
Bill Levy
John Miller
Joe Misek
Stephanie Page
Mike Penner
Harrison Pettit
Tim Raphael
Brent Searle
David Smith
Rick Wallace
Jim Walls