



**Washington Bioenergy – Status and Overview**  
**By Dave Sjoding, WSU Extension Energy Program**  
**Funded by U.S Department of Energy, Biomass Program**  
**Pacific Regional Biomass Energy Partnership**  
**Instrument # DE-FC51-02RO21322**  
**July, 2005**

## Introduction

The fast pace of bioenergy development in the State of Washington continues. This pace includes: 1) Bioproducts that offset up-stream use of petroleum or natural gas feedstocks, or add other new revenue streams; 2) Biofuels; and 3) Biopower. This year, like last year, is seeing a lot of activity including: 1) Completion of construction of the state's first major biodiesel plant. Seattle Biodiesel is 100% complete and testing is underway at 5,000 gallons per day. It is still awaiting their final operating permit; 2) Efforts to build crushers for oilseed based crops such as mustard, winter rapeseed and canola (see note under biodiesel feedstocks); and 3) Further bioproduct research efforts by WSU'S Center for Bioproducts and Bioenergy (CBB). The WSU Center for Sustaining Agriculture and Natural Resources (CSANR) is increasing its focus on Bioenergy separate from the Climate friendly Farming Initiative. The WSU bioenergy and bioproducts flyer was updated in July, 2005.

Biopower is the state's second largest renewable energy source (second only to hydropower). Power production alone is 370.75 MWc. This figure does not include biofuels, or heat from wood stoves. The forest products industry, especially pulp and paper mills, constitutes the greatest portion of this figure.

There are ten highlights for this month's report (greater details are below):

- 1) USDA/WSU held its Potato Cropping Systems Field Day at Paterson, WA on July 15, 2005. Two presentations were made on the expanded Biofuel Variety Trials: 1) Oilseed variety trials for biodiesel production; and 2) Switch grass trials for ethanol production;
- 2) A Tri-state Oilseed Crop university/USDA/Seattle Biodiesel meeting was held in Pullman, WA, on July 13, 2005;
- 3) A Hood Canal/Skokomish Valley digester field tour with stakeholder meetings was held July 13-14, 2005;
- 4) A biodiesel strategic planning collaboration meeting was held in Seattle, WA, on July 25, 2005;
- 5) Triple-Bio (Bioenergy, Bioproducts and BIOAg [reducing fossil energy inputs to agriculture by capturing ecosystem services such as energy efficiency and the use of biological controls of pests]) is emerging as a major program

- development initiative at WSU. A July 29th meeting was held with the Policy Consensus Center (U of W/WSU) focusing on Triple-Bio;
- 6) The Governor has announced a \$50,000 grant to Clallam County network for a feasibility study of an up to 5 MWc wood fired CHP facility at Forks. Mill waste would be the feedstock;
  - 7) The final draft of the *Biomass and Bioenergy Inventory and Assessment for Washington State* was circulated for final comment in July, 2005;
  - 8) The WSU Bioenergy and Bioproducts Team continues to develop. It focuses on coordination, direction setting and development. Dave Sjoding of PRBEP serves as Team Leader. This team includes the WSU Extension Energy Program; the WSU Center for Sustaining Agriculture and Natural Resources; the WSU Center for Bioproducts and Bioenergy (CBB) and others. CBB is research focused;
  - 9) Fact sheet development continues. Kim Lyon's *Biodiesel in Washington: A Snapshot* has proved to be timely and well received. Two other fact sheets have had further drafting: 1) Development of a WSU agreed upon specifications table for anaerobic digestion/energy calculations; and 2) A Vander Haak Dairy Biopower/Anaerobic Digestion overview; and
  - 10) The state government Bioenergy Team is now moving forward with a strategic planning focus. Monthly meetings are now being held.

This monthly report is intended to provide the status of all the various bioenergy activities in the state. It is now fairly comprehensive in its scope. It also provides information on the specific deliverables in the PRBEP award.

## Bioenergy Assessments

The State of Washington now has three completed bioenergy assessments. These assessments are building to a comprehensive assessment of the whole state which would include forest, agriculture, commercial/industrial and municipal bioenergy sources/feedstocks. The three current assessments are:

- 1) The *Logging and Agricultural Residue Supply Curves* authored by Dr. Kerstetter and Kim Lyons;
- 2) The *Wheat Straw for Ethanol Production* authored by Dr. Kerstetter and Kim Lyons; and
- 3) The *Bioenergy Inventory and Assessment for Eastern Washington* (September 2003) which is an agricultural and municipal bioenergy inventory and energy assessment authored by WSU (Shulin Chen and Craig Frear), INTEC (Julie Wallman) and the Washington State Department of Ecology (Mark Fuchs). This report shows that there is 4.3 million tons of excess biomass waste in Eastern Washington.

The *2004 Washington State Directory of Bioenergy Facilities* is in the final stages of development for publication. It describes all the current bioenergy facilities in Washington by type.

In addition, *The Greenhouse Gas Inventory of the State of Washington* by Dr. Kerstetter has now received a major update and restructuring at [http://qa.cted.wa.gov/\\_CTED/documents/ID\\_1280\\_Publications.pdf](http://qa.cted.wa.gov/_CTED/documents/ID_1280_Publications.pdf). This inventory helps point out the opportunities in bioenergy and agriculture.

The Department of Ecology has provided initial funding towards completing the assessment. WSU and the Department of Ecology have a near final draft of the *Biomass and Bioenergy Inventory and Assessment for Washington State*. Two meetings were held to discuss the location of the data including county level map information by feedstock volumes and to review the draft in detail. Final submission of edits and comments were completed in July, 2005 (Dave Sjoding and Jim Kerstetter made comments). Location data will be at the county level. To enable Arc View based economic analysis and business planning, site specific data will need to be developed. Additional funding is being sought to develop the information. The Washington Department of Agriculture's production data information will be used when possible. A portion of an SEP proposal includes this key step.

### **Technology Matrix – A Roadmap to New Washington Biobased Products and Energy**

A technology matrix is a roadmap of all the various WA feedstocks listed in the inventory. For each feedstock, there can be a variety of technologies applied with different products sold. This WA based map has not been developed, although there are some parts and pieces available. Some of the products are currently on the market, while others are in various stages of research, development and commercialization. The state-wide inventory/assessment will be followed by the development of a technology matrix by each feedstock. This information will create a market opportunities framework to shift from waste streams to revenue producing products. The Department of Ecology's new solid waste plan entitled *Beyond Waste* provides a sustainability framework for various feedstocks that used to be called "waste". Early framework/structuring considerations are being developed. A team of the Southeast RBEP, Washington, Hawaii and others is forming to tackle this matter. An ORE/CAL RC&D feedstock study was done by BBI and provides helpful background information. Initial structuring of both the current technology and the emerging technology was completed in July.

### **Energy Independence**

Connell – Connell is working toward energy independence (power and fuel) by establishing an energy business park. It is seeking funding for projects. This approach helps keep their energy/petrodollars at home.

### **Biopower**

Biopower – Agricultural and food processing anaerobic digestion projects summary  
A summary of agricultural anaerobic digestion efforts in Washington State is as follows:

- 1) Whatcom County – The state's first commercial dairy anaerobic digester began operation at the Vander Haak dairy farm in November, 2004. Six products are being sold or are under development: 1) Electricity; 2) The green power aspect of

the electricity; 3) Digested fiber to substitute for peat moss; 4) a crystallized phosphorous fertilizer; 5) CO<sub>2</sub> mitigation/greenhouse gas credits; and 6) Liquid fertilizer (returned to the dairies and off-setting regular fertilizer demands). See below for more information on these products. A two stage mixed plug-flow system is used. The Andgar Corporation of neighboring Ferndale was hired as project manager and constructed the digester, which is designed by GHD, Inc., a Wisconsin-based environmental engineering firm. In addition, two neighboring dairies have partnered with the Vander Haak Dairy for treating manure through the digester. Puget Sound Energy, through its green power program, purchases the renewable energy generated by the digester. The project generates enough electricity to serve 180 average homes (300 kWc). Partial funding came from a cost-share grant of \$272,000 from the U.S. Department of Agriculture, Rural Development's Renewable Energy Systems and Energy Efficiency Improvements Program (Section 9006 of the Energy Title of the Farm Bill). Vander Haak has also formed a partnership with Washington State University's CSANR/Climate Friendly Farming project (funded by the Paul G. Allen Foundation) to make the digester available to a WSU research team for environmental modeling, value-added product development, and outreach and demonstration to the dairy industry. A contract of \$160,000 to enable research, monitoring and outreach by the Climate Friendly Farming Project was provided by CSANR. Whatcom County has a very strong stakeholder effort. An additional combined heat and power (CHP) opportunity was explored with a greenhouse operation (there is still some excess waste heat from the power generation). However, water rights are an issue. An open house/field day was held March 10, 2005 and a Governor's visit on May 19, 2005;

- 2) Funding of \$684,000 was received in September from USDA's NRCS to evaluate two co-products of dairy anaerobic digestion: 1) a crystallized phosphorous fertilizer; and 2) A high quality digested fiber as a substitute for peat moss. This evaluation is being conducted in conjunction with the Vander Haak dairy;
- 3) The WSU CSANR/Climate Friendly Farming Project has several areas of focus including dairy, irrigated agriculture, dryland farming, socio-economics and modeling of the data. The dairy focus includes process improvements to optimize manure treatment, nutrient management, energy production, greenhouse gas mitigation, and co-product quality. Baseline data will be developed on greenhouse gas emissions, carbon and nitrogen cycling, energy flows, input costs, and management/labor costs;
- 4) King County for the Enumclaw Plateau dairy farms has completed an anaerobic digestion feasibility study. They are seeking funding for implementation. King County developed an RFQ to select a project developer. Note: It was posted on the King county website October 7, 2004 under RFQ number 159-04RLD. Seven proposals were submitted and evaluated. Teams of the seven submitters are invited to resubmit a final proposal that covers all aspects of construction and operation. An RFP final evaluation team was established by King County and four responses were received. They have been reviewed with individual interviews and follow-up questions. Answers are due August 5<sup>th</sup>. Discussions with dairy farmers on the plateau are on-going. This project has a strong focus on

- manure management for nutrient balances and improved surface and ground water quality in the watershed;
- 5) Snohomish County – A feasibility study with the Tulalip Tribe and local dairy farmers was funded by a DOE 2003 Tribal Energy Program grant of \$256,476. The study was done by the Clark Group and RCM Digesters. It included an inventory assessment of flushed and scraped manure volumes as well as non-dairy waste. Alternative digester technologies were reviewed. The Legislature has provided the land for the project as part of the Capital Budget. The USDA has provided a \$500,000 grant for construction (total cost estimate is \$2 million). The project is now in the EIS/permitting/selection of design option stage. The project is sized to handle 8 dairies. Initial construction is targeted for this summer. WSU's Joe Harrison, Dairy Specialist and RCM Digesters are working with the Snohomish Basin Biogas Partnership;
  - 6) Carbon Cycle Industries – This is an eastern Washington technology demonstration effort. The WSU Extension Energy Program has a non-disclosure agreement in place;
  - 7) Energy Northwest – The pilot demonstration of new “mesophilic plus” technology has been completed. Two nine million gallon lagoons were in operation. They did not reach the target of 3 MWs of production. The temperature of the lagoons never reached the optimum of 92 degrees. Partners included 5D Farms and Soil Search LLC. Stan Davison of Energy Northwest is the contact person. Results were:
    - a. An average of .3 kW/cow/day; and
    - b. Production went as high as .5 kW/cow/day at an 80 degree temperature.This is very good.

The goal of the project was to have a cost effective AD based only on the power sales. This meant reaching an ambitious power production rate of 1 kW/cow /day. Waste stream quality control and winter temperatures were the biggest problems. Energy Northwest was a guest at the dairy. There was no financial agreement. Energy Northwest continues to be interested in developing biopower projects. They have submitted a USDA Value added proposal;
  - 8) Straw to energy initiative (300 kWc) – This is a research/demonstration project. Washington agriculture is very diverse (over 300 farm products) and still maintains its family farm character. A straw to energy on-farm pilot project has been funded by Congressional earmark for \$750,000. This project gasifies grass straw (the feedstock) and is being developed in cooperation with Farm Power (Larry Albin), the Gady farm, USDA-ARS, PNNL, and BPA. The pilot plant has three phases (phases one and two are funded). Phase one includes technical characterization, specifications and economics. Phase two constructs the facility for biopower production and production of commercial grade carbon. Bench scale testing of a dual stage gassifier (Taylor Energy) has been completed. Permitting and then installation has begun with initial testing in September/October, 2005. If funded, phase three adds ethanol using a catalytic process. ;
  - 9) Digested fiber bench testing – WSU Whatcom County continues to bench test anaerobically digested fiber with the goal of meeting or exceeding peat moss

- standards. They are now having very promising results that should ultimately yield an improved revenue stream for anaerobic digestion projects. Eleven rounds of testing have been conducted;
- 10) WSU's two pilot scale 25 cow anaerobic digesters - The goals for this project are:  
1) The reduction of the capital cost of digesters; 2) The improvement of digester performance; and 3) The addition of high value co-products. The project's research, testing and demonstration will be done in a variety of settings. The initial digester is stationary at the WSU Pullman dairy. Construction is complete. It has a "study, test and learn" purpose. The results will be incorporated into the design of a second 25 cow mobile digester. The second digester will be tested in a variety of settings and with a variety of feedstock mixes. This digester will begin construction around 1/1/06. The digesters will be of novel design for single digestion or co-digestion of dairy manure and municipal and/or food solids. Two key novelties within the design are: 1) the separate treatment of solid and liquid organic materials; and 2) the development of a hydrolyzing solids reactor for high quality fiber production that works in concert with a high rate liquid digester for improved efficiency and biogas production. The goal of these design innovations is to lead to improvements in cost, enhanced efficiency of design, greater suitability for wastes with high solids content, and in particular an ability to produce more biogas and high quality fiber for resale as a soil amendment. Once built, the mobile digester will be transported to sites throughout the state for evaluation of its technical performance as well as for the collection of a wealth of data in regards to digestion and co-digestion of multiple and various waste streams. Funding of these pilots is from a number of sources. Various units within WSU (CSANR's Climate Friendly Farming Project, CAHNRs, Department of Animal Science, the Compost Facility, the Agricultural Research Center, WSU Extension) provided \$156,000. The Washington State Department of Ecology provided \$100,000. A Washington Technology Center grant of \$70,000 was matched by a cooperating partner, the Angar Corporation (\$35,000). A USDA Small Business Innovation Research Phase I Grant (in cooperation with Andgar) was secured for \$80,000. Angar is the construction firm. PRBEP Washington provided support in sizing the power system and conducted a tour of the lab (1 cow) and a 10 cow lagoon pilot;
  - 11) Puget Sound Clean Air Agency's Climate Protection Advisory Committee has completed the development of high impact strategies for climate protection. A number of strategies have been selected including centralized manure digesters. A final report was adopted in December, 2004;
  - 12) A number of food processors are required to digest their wastewater stream prior to its release into the municipal or regional wastewater system. For example, Penford Corporation does this in cooperation with the City of Richmond. It currently flares the gas and is exploring a biogas recovery project; and
  - 13) A biopower/anaerobic digestion factsheet was developed by Dave Sjoding entitled *Have you asked all the right questions* (version one). It was used at the anaerobic digestion workshop held on 2/25/05 in Sunnyside, WA, at the Snipes Mountain Brewery. The factsheet is now out for broader peer review. A

- second factsheet is being developed for the Vander Haak Dairy and an anaerobic digestion specifications chart. Both were further developed in July;
- 14) The Governor and the Legislature are focusing on the low oxygen levels of southern Hood Canal. It is one of only two west coast estuaries that have a low oxygen problem. The use of biopower/anaerobic digestion in a closed system (needed due to a flood plain) is a part of the solution under major consideration. A \$560,000 funding package has been proposed by the Governor and approved by the Legislature for the Skokomish Valley Anaerobic Digester. There is also Congressional interest. A tour with stakeholder meetings was taken on July 13-14, 2005 in Mason County, WA. The tour helped prepare for the study's statement of work; analyze feedstock volumes and seasonality; and discuss options, challenges and plans;
  - 15) A Stanwood, WA, group has submitted a biopower value added producer grant proposal to USDA; and
  - 16) Sunnyside Dairy submitted a biopower project proposal for the USDA 9006 funds.

**Total power produced: 300 kWc**

#### Biopower - Landfill gas/municipal solid waste/wastewater treatment facilities

The Department of Ecology requires flaring of landfill gas. This requirement yielded a reduction in greenhouse gas production from this source. A few sites were developed to produce power using federal tax credits which expired about 5 years ago. None have been developed since then except for the South Treatment Plant in Renton (see below). Power is being produced from eight facilities with one idle and one closed:

- 1) Bremerton Wastewater – 152 kWc, average operation is 70 kW;
- 2) King County wastewater - West Point Treatment Plant– 2.6 MWc (one unit idle so 1.3 MWa);
- 3) King County wastewater - South Treatment Plant, Renton – The 1.5 MWc Molten Carbonate fuel cell is currently operating at 1 MW with over 8,300 hours of operation and high reliability (93%). It operates at 65% efficiency with heat recovery;
- 4) LOTT (Thurston Co) – 719 kW;
- 5) LRI Landfill (Puyallup) – 2,775 kWc;
- 6) Roosevelt Regional Landfill (Klickitat Co.) - 10.5 MWc;
- 7) Spokane Trash-to-Energy Facility – 26 MWc, 22 MW net;
- 8) Spokane Wastewater - 300 kWc;
- 9) Spokane Northside Landfill – 900 kWc (idle – switching to microturbines)
- 10) Tacoma Steam Plant – 50 MWc – Closed – RFP has been issued to re-start. July discussions with EAC (a project developer) have been taking place. Supplemental feedstock is needed in addition to MSW.

**Total power being produced: 44.55 MWc and 38.66 MWa**

The King County South Treatment Plant in Renton, WA is the newest facility to come on-line. It is a 1 MW two year demonstration of a molten carbonate fuel cell system

which was developed in part with U.S. EPA funds. The waste heat is used on site making it a CHP facility. It has the capacity to reach 1.5 MW. The cost of this R&D project was \$22 million. Greg Bush is the King County project manager. The projected operating cost is equivalent to the cost of power from Puget Sound Energy.

Projects in various stages of development include:

- 1) King County has a second biopower/CHP project at the Renton facility. Construction is nearing completion (the turbines are installed) with a fall start-up. It is for 8 MW (two 3 ½ MWc turbines and one 1 MW steam turbine). The facility would use a combination of scrubbed biogas and natural gas to run at full capacity. The volume of biogas is sufficient for 3 ½ to 4 MWc of power;
- 2) King County is in the permitting and design phase of a 26 MWc facility at the Cedar Hills Regional Landfill. This would be the fourth largest landfill gas-to-energy project in the country. R. W. Beck has completed a major feasibility study of the project for King County and Energy Development Incorporated (EDI). Interconnection is needed to the BPA Covington transmission line and a Power Purchase Agreement;
- 3) King County is also planning to redevelop the West Point Treatment Plant. Power production will be boosted to 4.6 MW using a combination of biogas and natural gas. This project is in a much earlier stage of development and is scheduled to be on line June, 2006;
- 4) A new wastewater treatment plant at Woodinville, WA, is in the planning/design phase and will include the capability to install biopower; and
- 5) Fort Lewis is doing a feasibility study using landfill gas and possibly wastewater treatment plant gas for biopower CHP. SCS Engineers is doing the study. Possible size of power production is not yet determined. The draft study is due in August, 2005.

Scrubbing biogas and selling it into the natural gas pipeline as opposed to making power is an emerging shift in usage.

#### Biopower – Chemical recovery/burning spent liquor/wood waste/hog fuel

Pulp and paper mills often will produce biopower from two sources: 1) Burning spent liquor/chemical recovery of the ash; and 2) Burning hog fuel. Lumber and plywood mills burn the hog fuel for steam and power. Current systems (MWc) are as follows:

- 1) Avista, Kettle Falls - 50.7 MWc;
- 2) Colville Indian Power & Veneer – 7.5 MW (Retired for major repair)
- 3) Georgia Pacific, Camas – 52 MW;
- 4) Grays Harbor Paper LP – 5.5 MW
- 5) Kimberly-Clark, Everett – 52.2 MW;
- 6) Longview Fiber – 67.5 MW;
- 7) Port Townsend Paper – 14.5 MW;
- 8) SDS Lumber, Bingen – 8.5 MW;
- 9) Sierra Pacific, Aberdeen – 18 MW;
- 10) Vaagen Brothers Lumber, Colville – 4 MW
- 11) Weyerhaeuser, Cosmopolis – 15.5 MW; and

12) Weyerhaeuser, Longview – 30 MW.

**Total: 325.9 MWc**

A new biopower system was originally proposed for development by the Northwest Energy Systems Company under Darrington Energy LLC. It is now a 4-5 MW wood waste boiler system (downsized from an original 15 to 20 MW wood waste proposal). It is being developed by the Hampton lumber mill as part of the mill's expansion. Air quality issues raised by the U.S. Forest Service have now been resolved. The Washington State Department of Ecology and the Puget Sound Clean Air Agency have released a draft air quality permit.

Grays Harbor Paper (subject to financing) hopes to add additional CHP capacity using hog fuel (7 1/2 MW with an anticipated start date in December, 2005). They hope to qualify for the renewable energy tax credit and need financing. Their goal is to be electrical energy self sufficient (11-12 MW). They currently pay in 6 figures for their power.

**Total biopower: 370.75 MWc**

## Biofuels

### Introduction

The current biodiesel market in Washington has grown from a few thousand gallons in 2001 to a revised current estimate by Kim Lyons of approximately 1,500,000 gallons in 2004 (B-100 equivalent). It is no longer all tankered in by rail. The report entitled *Biodiesel in Washington: A Snapshot* has been further enhanced by Kim Lyons. The report covers the following topics: 1) Background; 2) Policy Actions; 3) Current biodiesel use; 4) Biodiesel operational issues; 5) Production; 6) Waste oils and grease; 7) Oilseeds; 8) Glycerin; and 9) Potential integrated oilseed/biodiesel projects. The state now has a major biodiesel production facility (Seattle Biodiesel with a 5 million gallon/year facility), one small producer of biodiesel using waste vegetable oil (Port Townsend) and 20 retail outlets. ARCO gasoline has sold gasohol for years using ethanol from the Olympia/Miller Beer brewing facility. It had a capacity of 1 million gallons per year and in recent years produced approximately 470,000 gallons/year. The closure of the brewing facility eliminated the only in-state ethanol supply. Ethanol is also tankered in by rail from the mid-west where it is produced from corn. A Pacific Rim proposal for a 50 million gallon ethanol plant at Moses Lake has died. Nevertheless, and like biopower, a number of new biofuel projects and efforts are now beginning. The biodiesel value chain has a number of main steps: 1) Growing the crop; 2) Crushing the seed; 3) Processing the oil into biodiesel 4) Blending the biodiesel at the wholesale level; and 5) Retail or final purchase and use.

### Growing the Crop - Biodiesel feedstocks

The agronomics, costs of various oilseeds, variety field trials, and other efforts for biofuels are under considerable discussion with active steps being taken to encourage the growing of oilseed crops (part of keeping our petrodollar in-state). Hal Collins of the

USDA Processor Agriculture Research Service is leading a variety trial. Winter rapeseed is 40-45% oil, and mustard is 22-25% oil. Collins has had surprising success with soybeans in his trials, which have lower production costs – though they lack some of the biofumigation benefits in some brassicas. Historic attempts to produce soybeans in the region have failed. The cost of the feedstock is 75% of the cost of biodiesel production (Jon Gerpen, Univ. of ID). Canola will likely continue to be part of the oleochemical industry. It is currently selling at 5-6 cents/lb on the Winnipeg Commodity Exchange. This is down from 30 cents/lb a couple of years ago. The break-even price necessary for farmers to produce brassica oil-crops ranges from \$.13 - \$.18 / lb for the seed depending on a variety of factors. \$.14/lb would likely spur significant production of these crops by dryland farmers in the intermediate and high-rainfall zones. This price gives the grower an option of trading out another crop in the potato or wheat rotation cycle. Therefore, the oilseed crop most likely to serve as a feedstock is either mustard or winter rapeseed (both also have the glucosinolate which acts as a biopesticide). Hal thinks there will not be a net loss in the effectiveness of mustards/rapeseed as a biopesticides if the crop is harvested with ripe seed as opposed to tilling the crop into the soil when still green. The net-value of the biopesticide effect of mustard cover crops used in rotation with potatoes ranged from \$90 - \$150/acre. Winter rapeseed is the much higher yielder for oil -- but there might be a tradeoff in water needs in dryland production. Successes with soybean production in Collin's biofuel trials, and new understandings of why these crops are working this time, could indicate that soybean production may also be a significant source of feedstock. This information is from a discussion of Hal Collins and Chad Kruger, WSU CSANR.

WSU/USDA-NRCS hosted a tri-state oil-seed crop and soils meeting in May, 2005 that included researchers from (WSU, NRCS, University of Idaho and Oregon State University). The purpose of the meeting was to discuss a major expansion of oilseed crop plantings. A follow-on meeting was held with Seattle Biodiesel on July 13, 2005, to further identify what is needed to bring about this major expansion.

### Oil seed variety trials

There are two oil seed variety trials being undertaken:

- 1) Hal Collins of the USDA Agriculture Research Service (ARS), Prosser continues to conduct biofuel variety trials. Information is available on pounds/acre and gallons/acre for various oil producing crops. A field day at Patterson, WA was held on July 15<sup>th</sup> to present the latest variety trial results. A paper entitled *Sustainable Production of Bioenergy Crops* and related PowerPoint presentation are available. Five major oil seed crops are being trialed including: rapeseed, mustard, sunflower, safflower and soybean; and
- 2) Natural Selection Farms of Sunnyside has done canola variety trials using municipal biosolids as the nutrient source in cooperation with ARS and the University of Washington. One variety was particularly productive;

### Biodiesel Production Technology Workshop

The University of Idaho held a biodiesel production technology workshop under Section 9004 of the energy title of the Farm Bill. Several attended from Washington. A second

two day workshop on biodiesel utilization and production is scheduled for September 15-16, 2005 in Boise, ID.

#### Biodiesel Crushing Projects

An important lesson in sizing crushing facilities is to ensure that there is a match to local crop production potential. Transportation costs between feedstock location and processing facility is always a major economic/business plan issue. A summary of proposed biodiesel crushing projects include:

- 1) Two small crushers are being developed in Lincoln County at Reardan Seeds and McKay Seeds;
- 2) A crusher is being developed in the Sunnyside area of Yakima County;
- 3) Columbia County developed a \$75,000 biodiesel production from oil seed business plan/feasibility study using USDA Value Added funds (\$50,000) and state funds (\$25,000). The high quality study was done by BBI. They are looking to secure \$32 million to build both an oilseed crushing and biodiesel plant sized at 10 to 17 million gallons per year;
- 4) Pacific Bio (An LLC composed of six agricultural coops in Spokane and Whitman counties) are developing of a 1.5 mg/yr crushing facility (sized for local production); Business, financial, and marketing plans have been completed. They are focused on crushing mustard and selling the co-product (mustard meal) and canola. A key meeting was held in late July. They are proceeding with spring contracts with growers;
- 5) The City of Connell is looking to develop an energy park that includes both crushing and biodiesel production as part of a larger effort.

#### Biodiesel plants

Five biodiesel plants are in various stages of planning, construction and operation:

- 1) Seattle Biodiesel has completed construction, is testing the product and is awaiting receipt of their final operating permit. It is a 5 million gallon/year facility. They are looking for virgin oil like canola or mustard (preferably from Washington). This would complete the in-state production loop. Current feedstock includes soybean oil from the mid-west and canola oil from Canada;
- 2) Baker Commodities is proposing to use its recycled yellow grease for a 2 to 8 million gallon facility. A re-calculation of facility development costs has been completed (they are higher). Baker Commodities is paid to take the feedstock. This gives them a resiliency against decisions by OPEC to suddenly drop the price of oil. Various locations are being considered;
- 3) Sound Biodiesel of Port Townsend has developed its facility and is producing biodiesel from waste vegetable oil. It is to become a 10,000 gal/yr facility (2,000 gallon start-up capacity);
- 4) Washington Biodiesel is looking at several sites in Washington for a 10 million gallon/year biodiesel facility using waste grease, tallow, and oil from oil seed as feedstock. They are also looking into co-locating a crusher; and
- 5) Sustainable Systems of Missoula, MT, is looking at developing a biodiesel plant in Spokane.

### Blending/wholesale/retail and market development

Biodiesel can be blended with regular diesel at any percentage (B20 is 20% biodiesel) A number of market pull efforts using ASTM quality biodiesel are underway:

- 1) The state now has two blenders of biodiesel (Pacific Fluids and Pacific Northwest Energy Company);
- 2) A number of governmental units are now buying biodiesel including King County (Metro buses), Seattle, Tacoma, Olympia, Intercity Transit (Thurston County); Jefferson Transit, Central Valley School District; U.S. Navy, Fort Lewis, and Mc Chord AFB. Biodiesel is now on the state government contract list for purchase.
- 3) The Washington State Clean School Bus Program Report to the 2005 Legislature <http://www.ecy.wa.gov/pubs/0402029.pdf> is now available as part of 2003 legislation (ESSB 6072);
- 4) The Washington State Ferry System has placed on hold its biodiesel purchases due to a fuel line clogging problem. Laboratory analysis the clogging material conducted by Univ. of ID revealed a high iron content (50%). In addition, the bottom of a tank that was later drained for maintenance revealed some normal bacterial growth (the bacteria is common to all diesel products). It would appear that serious and detailed tank cleaning is needed for conversion of very old diesel engine fuel tanks. There is a \$500,000 U.S. Senate Energy and Water Committee appropriation earmark for this demonstration;
- 5) Retail level sales are continuing to grow in the state (20 stations in a variety of locations throughout the state); and
- 6) Garage scale and larger production of biodiesel also has its adherents. For example, Olympia Green Fuels has both a 400 gallon and 1,200 gallon per batch biodiesel production systems. The feed stock is free yellow grease/waste vegetable oil from local restaurants;

### Ethanol

There are now three ethanol efforts in the state:

- 1) Phase three of the straw to energy proposal (mentioned above) adds an ethanol component. There is now discussion among Washington corn growers (260,000 acres in 2002) of development of an ethanol industry. The Potato Cropping Field Day at Patterson, WA, on July 15<sup>th</sup> will present switch grass trials for ethanol production;
- 2) In 1997 WSU Dr. Jim Kerstetter in cooperation with Dartmouth College published an *Assessment of Potential for Conversion of Pulp and Paper Sludge to Ethanol Fuel in the Pacific Northwest* for NREL. Pulp and paper sludge is an excellent place to begin building an ethanol industry in the Northwest. There are no additional feedstock transportation costs and pre-processing of the feedstock has already taken place. A review of this report was completed in July with an eye to updating and perhaps placement on the website;
- 3) A proposal to study low-lignin wheat and barley for ethanol production has been developed WSU and the University of Idaho;
- 4) ARS Prosser (Steve Fransen of WSU) has preliminary research plot yields for corn, wheat straw and switchgrass (a perennial). Early results show the yields 6-7

tons of dry matter per acre. Approximately 50,000 acres would support a 20 million gallon per year ethanol facility. Corn and switchgrass are similar in ethanol productive capacity per ton (80 gallons).

#### Biofuels Stakeholder Groups and Events

Washington has an abundance of biofuel groups, involved stakeholders and meetings. A Biodiesel Summit was convened for January 26, 2004, in Seattle. The state's first broad based biodiesel meeting since January, 2004 was held in Seattle on July 25, 2005. Approximately 35 people were in attendance. A time of brief presentations by various parties and interests was followed by discussion of policies to advance biodiesel.

Here is a list of biodiesel stakeholder efforts:

- 1) Clean Cities Coalitions (5-6 meetings per year) with a rising emphasis on biodiesel. This is the original group;
- 2) Northwest CAPP's Biodiesel Work Group;
- 3) Puget Sound Biodiesel Round Table (many federal agencies);
- 4) Climate Solution's Pacific Northwest Biofuels Network;
- 5) Governor's Sustainability Task Force ( A biodiesel Roundtable was held March 30, 2005, by the Department of General Administration);
- 6) Spokane County Conservation District (Jim Armstrong and Linda Graham);
- 7) Northwest Biodiesel Network (a Seattle based group) held its Third Northwest Biodiesel Forum on March, 19, 2005. It was well attended; and
- 8) Port Townsend Biodiesel

A Northwest Farmers Bioenergy Trade Group has been proposed by the Institute for Washington's Future. Its first focus is on development of a mustard meal biopesticide market. A somewhat similar proposal with a northwest biodiesel logo is emerging from Climate Solutions.

#### **Bio-gasification and direct heat**

The J&J Bosma Dairy has received a USDA value added planning award of \$85,000 to examine the feasibility of compressing digester biogas to liquid natural gas. Prometheus Energy of Bellevue, WA, provides technical support and CSANR of WSU will provide project evaluation support. An application for USDA 9006 funds was recently submitted.

The Big Island, Virginia paper mill of Georgia Pacific is the site of a major demonstration using gasification/pulsed steam reforming technology as opposed to the traditional burning of the spent liquors. This is a technology development that bears serious watching. It is part of the Agenda 2020 of the American Forest & Paper Association. Georgia Pacific is partnered with ThermoChem Recovery International.

Seattle Steam is considering use of waste wood to produce steam for its district energy system in order to offset fossil energy (natural gas). Two modular boilers would be needed, each capable of producing 41,000 lbs/hr of saturated steam at 250 psig. They want to convert 50% of their natural gas to wood fuel.

## **Bioproducts and research**

### Bioproducts and the WSU Center for Bioproducts and Bioenergy (CBB)

It has long been the case that co-products are a major key to the financial success of bioenergy projects. The Vander Haak Dairy (mentioned above) is moving to produce 6 products/revenue streams. In the Pacific Northwest, the need for co-products of bioenergy is a “given”. The research, development and demonstration of these co-products continues to be a core need for further advancement of bioenergy. In addition, WSU’s CBB has a number of focused efforts relating to bioenergy. They focus on converting agricultural and biological waste streams to new products, including several that are energy related:

- 1) Glycerol is a co-product of biodiesel. From it can come: 1) A pharmaceutical [omega-3 fatty acids (DHA and EPA)]; 2) Specific fermenting bacteria that can be used in biorefineries to produce a variety of products such as PTT (a new polyester); 3) Bacteriocins (bacteriocin is a bacteriocidal protein); 4) Algae high in omega-3 to be used as an animal feed supplement (American Premix Technologies and WSU CBB have received a WTC award to develop this product); and 5) Succinic acid. In addition, a sixth co-product from brassica based oilseed crops/rapeseed meal is biopesticides. From a broad perspective, a whole new world is opening up for agricultural products with the national goal to offset petroleum based feedstocks;
- 2) Production of ethanol from wheat straw;
- 3) Development of new digester technology (see above) for a variety of research, testing and demonstration projects focused on struvite and high quality fiber; and
- 4) A biorefinery process analysis and design curriculum is being developed in cooperation with the Univ. of Idaho, and Michigan State.

Non-energy related efforts include: 1) Nisin (a food preservative) and lactic acid from milk whey; 2) Chitosan and lactic acid from cull potatoes

## **Key national contacts**

### National Biomass State and Regional Partnership Collaboration (NBSRPC)

Jake Fey, Director, WSU Extension Energy Program continues to serve on the national collaborative. They hold quarterly meetings and have conference calls when needed. They have focused on program metrics, program outreach, and funding issues. Jake Fey and Dave Sjoding attended the meeting in Seattle in March, 2005.

### Biomass Research and Development Technical Advisory Committee

Dr. Ralph Cavalieri, Director, WSU Agricultural Research Center, serves on the national advisory committee that gives guidance to the DOE and USDA joint Biomass Board. In 2000 the Biomass Research and Development Act was passed establishing a joint effort by DOE and USDA. Since then, the Biomass Research & Development Initiative was established to implement the act. This initiative is lead by the Biomass Board.

### Association of State Energy Research and Technology Transfer Institutes (ASERTTI) Bioenergy Committee

ASERTTI has formed a Bioenergy Committee. Dave Sjoding serves as a member.

National Association of State Energy Officials (NASEO) Agricultural Task Force  
NASEO has an Agricultural Task Force. Dave Sjoding serves as a member.

### **Siting and Permitting Issues**

Introduction – Siting and permitting of bioenergy facilities (biodiesel facilities and biopower) is new to local government and air quality jurisdictions. Clear permitting processes are needed combined with training.

Seattle – Seattle Biodiesel has not received its final operating permit.

Department of Ecology – The Department of Ecology has received \$35,000 from EPA to develop a biodiesel permitting guide with the goal of standardizing the requirements. The report should be done in January, 2006 followed by several workshops for local governments. Contact Rob Reuter at 425.649.7086.

Klickitat County – An “Energy Overlay” has been developed with a non-site specific EIS. The overlay was adopted by the county commissioners on March 15, 2005. This is the first county in the country to take this approach. The final EIS received a second public hearing by the Planning Commission. It is intended for this energy overlay to be part of the county’s land use plan. This overlay would significantly speed-up the permitting process. Bioenergy was dropped from the overlay as part of last minute discussions (SDS Lumber [the potential developer] is located inside the city limits of Bingen). The county has spent approximately \$500,000 in support of this effort. For additional information contact Dana Peck at (509) 773-7060.

### **Other Pacific Regional Biomass Energy Partnership Washington Activities**

#### Strategic, policy and governmental

The following efforts are underway:

- 1) The beginnings of broad discussion leading to a state biodiesel strategy began to emerge at the Biodiesel meeting in Seattle on July 25, 2005. Further meetings will follow;
- 2) The multi-state regional strategic plan and metrics under PRBEP continues its development. A number of versions have been reviewed with comments/edits developed. A simplified version emerged from the PRBEP peer meeting in April, 2005. The Statement of Objectives will be used for metrics;
- 3) Biopower from digesters need utility interconnection. SSB 5101 has been signed into law with a requirement that 80 percent of the state’s total customer load have uniform interconnection standards before the law takes effect. Uniformity means 90% of interconnection requirements are the same. Adoption of uniform interconnection standards for digester sized power production will be helpful. The Washington Utilities and Transportation Commission and the Washington Public Utility District

- Association are going to launch public processes to develop the standards. SSB 5101 focuses mainly on solar and community wind by providing a fixed purchase price from utilities. However, small anaerobic digesters are also benefited. However, payments for these renewable energy systems are limited to \$2,000/year;
- 4) Purchase of biodiesel and other biobased (sustainable) products is an increasing focus of state and local governments. Problems with fuel quality have emerged for the state's ferry fleet. They are partnered with the University of Idaho to determine the cause of clogged fuel filters; and
  - 5) State government now has a bioenergy group that meets monthly. The WSU Extension Energy Program participates.

#### Technical assistance and outreach

WSU Extension Energy Program provides technical assistance and outreach on a wide variety of bioenergy topics. This effort includes serving as technical expert for a variety of meetings and groups, working with procurement officials wanting to purchase biodiesel, and advancing new technologies.

Technical support was provided for the Washington State Grange (broad bioenergy questions), Spokane Conservation District (biodiesel); Mason County Conservation District (anaerobic digestion); and Okanogan Economic Development (forest feedstock and biooil).

#### Library/clearinghouse for information

The WSU Energy Library continues to update of the collection of bioenergy materials. The summer of 2004 was designated as the time to organize the collection into a logical topic structure that fits with the Library of Congress catalogue system and library users. Library staff worked to maximize access to the 378 bioenergy titles listed in the library catalog. In addition to biomass energy as a search topic, the following other topics are also useful:

- Feedstock
- Refuse as fuel
- Anaerobic digestion
- Alcohol as fuel
- Manures
- Ethanol fuels
- Motor fuels
- Methane
- Wood fuels
- Biomass chemicals
- Methanol as fuel

WSU is the intake and quick answer provider of bioenergy questions for the new EERE Information Center in cooperation with RSIS (a computer services firm) and NCI which handles the EERE publications warehouse. The toll free number is 877.337.3463. The e-mail address is [ereic@ee.doe.gov](mailto:ereic@ee.doe.gov)

### PRBEP website

The Pacific Regional Biomass Energy Partnership website is located at <http://www.pacificbiomass.org/>. Active collection of new website materials for an update is underway. A number of additional materials were discovered at the peer meeting. The website has been selected as the site for the Washington Biomass Inventory maps and data. A working draft of the maps and data has been prepared and is awaiting final production of the report and data. The website has a new masthead look. Biodiesel crops in bloom with trees replaced the corn cob (a more “Pacific” look).

### Future events, conferences, meetings and workshops

The following future conferences, workshops, field days and meetings are scheduled:

- 1) U.S. Senator Cantwell will be touring various Washington Counties to discuss biodiesel in early August.
- 2) A WSU/PNNL bioproducts/bioenergy meeting will be held in Pullman, WA on August 19, 2005;
- 3) A University of Idaho Biodiesel Utilization and Production workshop is scheduled for September 15-16, 2005 in Boise, ID;
- 4) Alaska Rural Energy Conference September 20-22, 2005 in Valdez, Alaska with the PRBEP Peer Exchange on September 23;
- 5) The Northwest Renewable Energy Festival will be held September 23-25, 2005 in Walla Walla, WA;
- 6) A Global Oil Depletion and Implications for the Pacific Northwest Conference is being planned for October 4-5 in Spokane, WA. Dave Sjoding will lead a panel discussion of biofuels & bioproducts in the Pacific Northwest;
- 7) Tilth Producers Conference will be held November 11-13, 2005 in Wenatchee, WA. A pre-conference symposium on Alternative Energy on the Farm will be held on November 11 from 10:00 to 5:00;
- 8) The Spokane Ag Expo & Pacific Farm Forum will be held January 17-19, 2006. It will have a Bioenergy Pavilion;
- 9) The Harvesting Clean Energy Conference will be held in Spokane on February 27-28, 2006. There are monthly discussions. The start of a proposed agenda for “How much can we Harvest” panel was prepared. An early discussion with Jeff King of the Northwest Power & Conservation Council along the lines of “what we know, what we don’t know, how we use the information and needs steps to fill knowledge gaps”. Dave Sjoding participates in the planning; and
- 10) A second Oilseed Summit is in the discussion stages for March 1, 2006, as a follow-up meeting to the Harvesting Clean Energy Conference.

The following bioenergy monthly meetings are now routinely functioning;

- 1) A state government bioenergy group has formed and is now meeting monthly;
- 2) The regional Biopower Work Group led by Climate Solutions meets by phone on the second Thursday of every month at 10 AM; and

- 3) The Northwest Biofuels Network led by Climate Solutions meets by phone on the first Wednesday of every month at 10 AM.

#### Funding

In addition to the PREBP proposals, a number of bioenergy proposals have been submitted in recent months or are under development. They are:

- 1) A Triple-Bio concept white paper is under development for major funding for BIOAg, bioenergy and bioproducts (see above);
- 2) Following the January initial set of meetings to develop new uses of glycerin, a proposal was submitted to the USDA for the Biomass Research and Development Initiative. Two platform chemicals were presented for product development: Succinic acid and glucosinolates;
- 3) A “Buy Bio in Washington” proposal was submitted for the Dept. of Energy State Energy Program’s competitive grant process; and
- 4) A number of USDA value added producer Grants and 9006 energy grants have been submitted from Washington.

USDA Rural Development’s energy efficiency and renewable energy Farm Bill Section 9006 rules are now final. The Rural Development Service is shifting to a year round continuous submittal window as opposed to the previous approach of a specific grant submittal deadline. \$200,000,000 in 9006 loan guarantee funds are now available. The deadline of applications is August 31, 2005.

#### Staffing

Staffing of the program is as follows:

- 1) David Sjoding serves as Principal investigator for the Washington portion of the Pacific Regional Biomass Energy Partnership (PRBEP) with a focus on Biopower and bioproducts;
- 2) Kim Lyons focuses on biofuels; and
- 3) Dr. Jim Kerstetter continues on an hourly basis with a focus on special technical questions and the state’s greenhouse gas inventory. The latter assignment is funded by the Washington Department of Community, Trade and Economic Development.

If you have questions or can provide additional information, please contact Dave Sjoding, Renewable Energy Specialist at 360.956.2004 or [sjodingd@energy.wsu.edu](mailto:sjodingd@energy.wsu.edu).