APPENDIX A. SUMMARY OF KEY REGIONAL STUDIES

1. BLUE MOUNTAINS VEGETATION ASSESSMENT

This study consisted of three major task areas:

- Analysis of historical management activities and forest conditions
- Identification of overstocked stands; and
- Estimation of potential timber availability from overstocked stands.

The analysis of overstocked stands and potential timber volumes from these stands focused on National Forest land. The Oregon Department of Forestry provided estimates of overstocked stands on private lands.

The methods to perform each of these task areas are described below.

<u>Historical timber harvest and management</u>

The USDA TRACS-SILVA database provided acres of timber harvest, forest density management and reforestation attainments by fiscal year. Timber harvest volumes on private and National Forest lands in Baker, Grant, Harney, Malheur, Umatilla, Union, Wallowa and Wheeler Counties were determined using Oregon Department of Forestry timber harvest reports.

<u>Identification of overstocked stands</u>

Estimation of overstocked stand acreage focused on National Forest planning allocation areas called active forestry (where sustained timber harvest is permitted and likely to occur), restricted (riparian, roadless and old growth areas where timber harvest is permitted) and Lynx habitat (where timber harvest is permitted but timber harvest may be limited). The analysis excluded areas with non-forested conditions and forest reserves, which have legal, regulatory or Forest Plan restrictions on timber harvesting.

Aerial photo interpretation and analysis of existing vegetation data were used to identify overstocked stands in Umatilla and Wallowa-Whitman National Forests. Potential vegetation types, or plant associations, were aggregated into biophysical groups. Overstocking thresholds for each biophysical group were identified using methods described in Cochran et al. (Cochran)[121] and Powell.[122] Where stand information on numbers of trees or basal area per acre was not available, canopy closure was used as a surrogate for stand density and stand density thresholds.

Figure A-1 shows the location of forest planning allocations on National Forest land in the Blue Mountains.

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[121] Cochran, Geist, Clemens, Clausnitzer and Powell. *Suggested Stocking Levels for Forest Stands in Northeastern Oregon and Southeastern Washington, Research Note. RN-513* (Pacific Northwest Research Station, 1994).
[122] Powell, *Suggested Stocking Levels for Forest Stands in Northeastern Oregon and Southeastern Washington: An Implementation Guide for the Umatilla National Forest*, F14-SO-TP-03-1999 (USDA Forest Service, Umatilla National Forest, 1999).

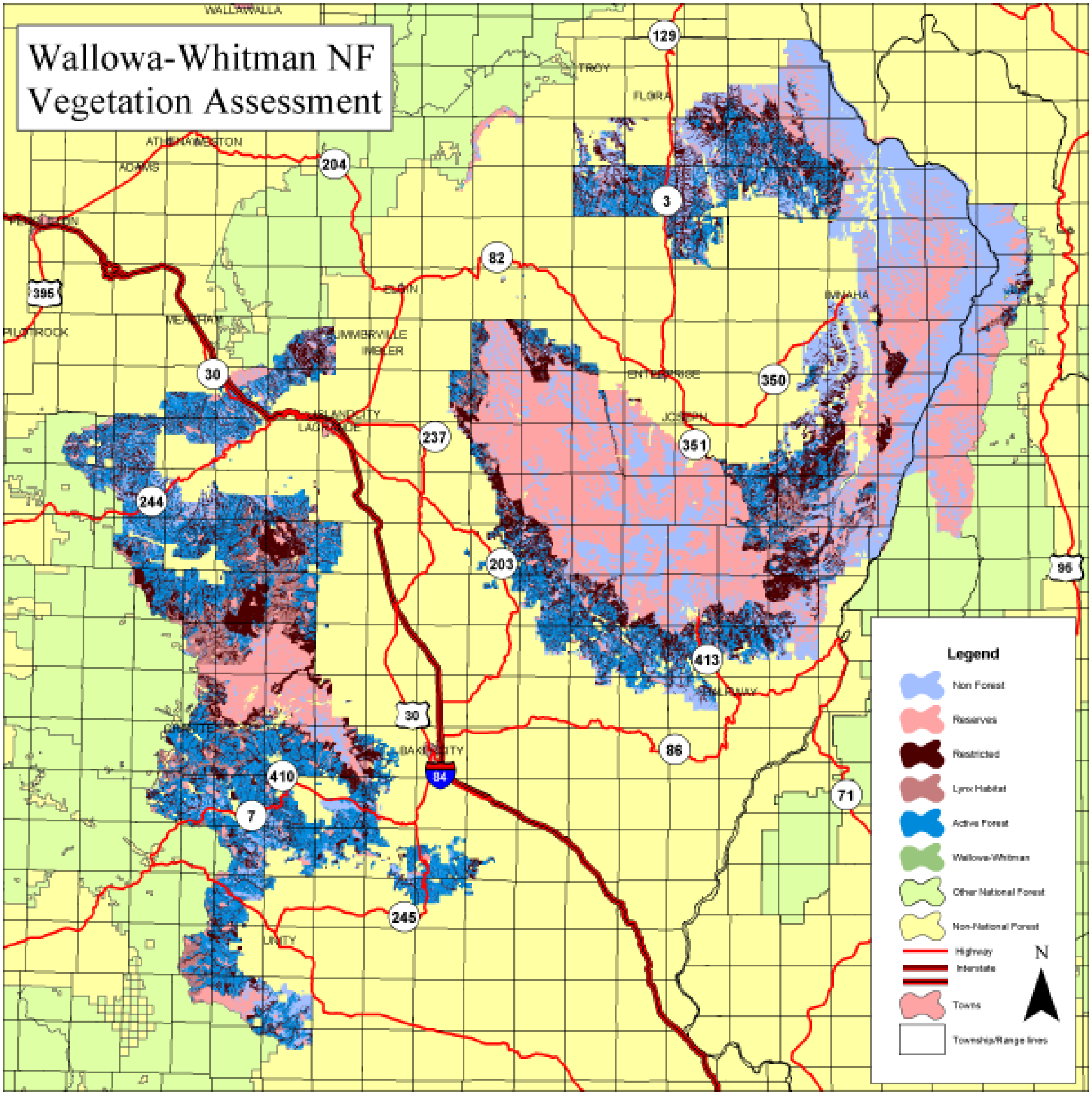

Figure A-1. Map of National Forest land showing location of active forestry and other forest management allocations in the Blue Mountains region

<u>Timber availability</u>

Continuous vegetation survey (CVS) inventory plot data from 1994 to 2001 and forest planning allocation data was used in the Forest Vegetation Simulator (FVS), a mathematical growth and yield model, to project potential timber volumes in active forestry areas in 2002. Non-forest and late and old forest structure CVS plots were removed. If multiple species were present, a preference was established that favored leaving western white pine, western larch and ponderosa pine over all other species.

Maximum Stand Density Indices (SDI) and desired residual stand densities for plots were determined based upon the plant association and stand densities identified in Cochran and Powell. Plot stand densities were compared with the maximum indices described in these papers. Plots that met the following conditions were considered overstocked and were thinned as described:

- If the stand density was more than 45% of the maximum SDI for the plot's plant association, then the stand was thinned to 35% of the maximum SDI.
- If the stand density was less than 45% of the maximum SDI for the plot's plant association, but the number of trees/acre (TPA) with diameters ranging from 0.1 to seven inches diameter breast height (DBH) was greater than 300, the stand was thinned to 135 TPA.

The stand prescription within the FVS model was "thinning from below" which emphasizes removal of smaller trees and leaving larger trees. An exception was that trees with severe mistletoe infection or other serious damage were marked for removal.

Economic analysis

Financial outcomes for management were estimated using the Financial Analysis of Ecosystem Management Activities model (FEEMA) (http://www.fs.fed.us/pnw/data/feema/feema.htm). Economics were analyzed only for removal of merchantable material. Analysis of costs for removal of non-merchantable materials was not performed.

Sawlog harvest costs in dollars per hundred cubic feet ($/CCF) for each stand were assigned based upon log size and the number of trees harvested per acre (Table A-1). Cable-based yarding systems were assumed on slopes greater than 35%.

Table A-1. Harvesting cost assumptions (in dollars per hundred cubic feet)

Tree size (CF/tree)	**Number of cut trees/acre**					
	5	**20**	**50**	**100**	**200**	**400**
Ground based harvest system						
3	104	97				
5	85	78	73			
10	67	61	57	54		
50	41	38	38	36	36	
100	38	38	38	38	36	35
150	37	37	37	37	36	35
Cable harvest system						
3	368	257				
5	385	232	178			
10	296	207	141	119		
50	86	82	75	73	72	
100	71	59	57	57	56	56
150	57	55	54	54	54	54

Table A-2 presents a range of estimated delivered sawlog costs based on the harvest cost inputs from Table A-1. These costs assume average conditions for hauling, road maintenance, contractual, and temporary road costs. The costs in Table A-2 do not represent costs of removing non-merchantable materials.

Table A-2. Estimated range of delivered sawlog costs

Cost component		**Ground-based systems**			**Cable-based systems**		
		$/CCF	$/GT[a]	$/MBF[b]	$/CCF	$/GT[a]	$/MBF[b]
Harvest costs	Low	$35.00	$68.83	$420.00	$54.00	$-	$648.00
	High	$104.00	$204.53	$1,248.00	$368.00	$-	$4,416.00
Other costs	Hauling	$27.00	$53.10	$324.00	$27.00	$53.10	$324.00
	Road Maintenance	$7.00	$13.77	$84.00	$7.00	$13.77	$84.00
	Contractual	$9.00	$17.70	$108.00	$9.00	$17.70	$108.00
	Temp. Roads	$1.00	$1.97	$12.00	$1.00	$1.97	$12.00
Delivered sawlog costs[c]	Low	$79.00	$155.37	$948.00	$98.00	$86.53	$1,176.00
	High	$121.00	$237.97	$1,452.00	$385.00	$33.43	$4,620.00

[a]Conversion from $/CCF to $/GT assumes 0.020 GT/cubic foot, based on an average of values for western white pine, Douglas-fir and ponderosa pine. Source: Colorado State Forest Service, *Forest Products Utilization Handbook* (Colorado State University, 1980), p. D-10.
[b]MBF= thousand board feet
[c] Delivered sawlog costs are the sum of harvesting and other costs.

Costs were assigned to individual forest stands based on the size and number of stems harvested per acre using cost values from Table A-1.

Positive net values resulted when log values exceeded total operation costs. Product prices for the 4th quarter of 1999 and the 4th quarter of 2001 were averaged to estimate the wood value for each log species group (Table A-3).

Table A-3. Assumed dollar value of logs delivered to a mill ($/CCF) by species grouping and small end diameter

Small End Diameter (inches)	**Douglas-fir and Larch**	**Hemlock, Grand fir and Engelmann spruce**	**Ponderosa pine**	**Lodgepole pine**
4	1	1	1	1
6	90	58	11	43
7	143	106	84	100
10	186	144	155	142
13	210	166	206	163
16	225	180	248	173
19	236	190	284	178

Source: Oregon Department of Forestry, Timber Sales, Log Price & Scaling Information. On-line: http://www.odf.state.or.us/DIVISIONS/management/asset_management/

Table A-4 summarizes the availability of National Forest land for timber harvest in the Blue Mountain region.

Table A-4. Acreage of Blue Mountains National Forest land in each land availability category

Category	Malheur		Umatilla		Wallowa-Whitman		Total	
Non-Forest	484,000	29%	188,000	13%	727,000	30%	1,400,000	26%
Reserved	248,000	15%	483,000	34%	648,000	27%	1,378,000	25%
Restricted	312,000	18%	180,000	13%	426,000	18%	918,000	17%
Lynx	7,000	<1%	105,000	8%	76,000	3%	189,000	3%
Active Forestry	647,000	38%	452,000	32%	517,000	22%	1,616,000	29%
Total	1,698,000	100%	1,408,000	100%	2,394,000	100%	5,500,000	100%

Table A-5 shows county-level estimates of acreage of overstocked forest stands on National Forest land.

Table A-5. Estimates of overstocked acres on National Forests within each county, number of inventory plots used to develop estimates and error margins

County	**Overstocked area** (000 acres)	**Number of plots**	**Overstocked area** (000 acres) yield < 4 CCF per acre of merchantable timber	**Number of Plots**	**Overstocked area** (000 acres) yield > 4 CCF per acre of merchantable timber	**Error margin** +/-	**Number of plots**
Baker	113	88	42	32	71	4	56
Grant	391	260	188	123	203	9	137
Harney	167	117	90	61	77	5	56
Morrow	51	26	33	17	18	3	9
Umatilla	58	35	38	24	20	5	11
Union	89	77	45	38	44	6	39
Wallowa	49	41	22	19	27	6	22
Crook/ Wheeler	25	14	12	7	13	2	7
Total	943	572	472	235	471	16	337

Table A-6 shows the species group composition of the sawlog volumes.

Table A-6. Percentage of sawlog volume by species group

County	Douglas fir (%)	Grand fir (%)	Ponderosa pine (%)	Lodgepole pine (%)	Juniper (%)	Larch (%)	Alpine fir/ E. spruce (%)
Baker	41	19	26	6	4	2	2
Grant	34	26	20	14	4	2	0
Harney	25	17	49	0	9	0	0
Morrow	44	17	7	15	1	11	5
Umatilla	29	28	0	34	0	1	8
Union	40	23	4	22	0	8	2
Wallowa	38	24	4	16	0	10	9
Crook/ Wheeler	41	21	26	0	2	3	6
Total	35	23	22	12	4	3	2

Table A-7 shows the estimated number of acres that can be harvested for various net present values based on the economic analysis.

Table A-7. Acreage of overstocked active forestry land (thousand acres) by net present value of harvesting operations in Blue Mountains (National Forests only)

County	Net Present Value of Treatment				
	< -$750	-$500 to -$750	-$500 to $0	$0 to $500	>$500
Baker	16.5	7.1	36.4	8.1	1.5
Grant	44.9	23.0	123.1	11.2	0.0
Harney	7	11.7	47.0	8.9	0.0
Morrow	4.3	2.4	9.9	0.9	0.0
Umatilla	1.4	4.3	14.0	0.0	0.0
Union	7.1	8.4	24.3	4.1	0.0
Wallowa	4.2	2.2	18.2	2.4	0.0
Other	6.2	4.1	0	2.7	0.0
Total	91.6	63.2	272.9	38.3	1.5

Figure A-2 shows the county-level distribution of overstocked stands by net present value of treatment.

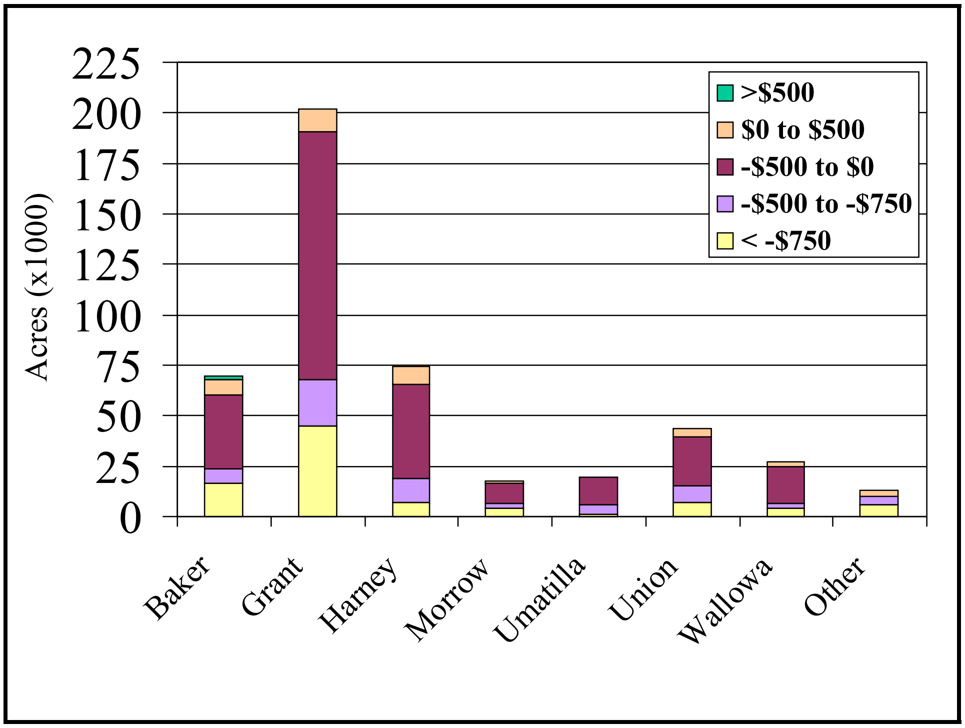

Figure A-2. Acres of overstocked stands on National Forest land by county and distribution of net values associated with thinning

Table A-8 shows the estimated number of overstocked acres on private land in the region.

Table A-8. Estimated overstocked acres on private forest land in the Blue Mountains

County	Overstocked acreage on non-industrial private lands (thousand acres)	Overstocked acreage on industrial lands (thousand acres)	Total (thousand acres)
Baker	36	4	40
Umatilla	50	22	72
Union	54	34	88
Wallowa	45	40	85
Other[a]	234	62	296
Total	419	162	581

[a] Other includes Grant, Wheeler, Harney, Morrow and Gilliam Counties

Table A-9 shows the estimated potential sawlog and gross volume of merchantable materials that can be harvested from overstocked stands with a minimum yield of 400 cubic feet per acre.

Table A-9. Potential sawlog and gross volumes from overstocked National Forest stands yielding more than 400 CF/acre

County	**Potential sawlog volume** (MMBF)	**Error margin (+/-)**	**Potential gross cubic foot volume** (thousand CF)	**Error margin (+/-)**
Baker	236	31	61	6
Grant	590	45	174	12
Harney	200	21	60	6
Morrow	68	23	18	6
Umatilla	73	24	20	6
Union	143	48	39	6
Wallowa	128	36	32	11
Crook and Wheeler	78	36	22	9
Total	1,517	95	425	24

Douglas fir, grand fir and ponderosa pine make up 80% of the volume of sawlog volume that could be removed from overstocked stands in active forestry planning areas of National Forest land in the Blue Mountains region (Table A-6).

The sawlog volume that could be removed from overstocked stands on active forestry land in the region that would result in a positive net value is 167 MMBF (+/- 36) (Table A-10).

Table A-10. Number of overstocked acres and timber volume where thinning would result in a positive net value on National Forest land

County	**Overstocked area with a positive net value** (000 acres)	**Error margin** (+/-)[a]	**Sawlog volume with a positive net value** (MMBF)	**Error margin** (+/-)[a]	**Gross volume with a positive net value** (MMCF)	**Error margin** (+/-)[a]
Baker	9.6	1.8	49	16	11	4
Grant	11.2	2.6	42	13	10	3
Harney	8.9	2.5	27	12	8	3
Morrow	1.0	-	3	-	1	-
Umatilla	0	-	0	-	0	-
Union	4.1	2.6	14	8	3	2
Wallowa	2.4	-	21	-	5	-
Crook/ Wheeler	2.7	4.8	10	4	3	2
Total	39.9	4.6	167	36	41	8

[a] The symbol "-" indicates that no confidence limits could be estimated because less than two plots were available.

2. DRY FUELS MECHANICAL TREATMENT STUDY

This study evaluated equipment productivity and cost, fuels and fire risk impacts and soil impacts of biomass removal at four sites in three states.

Of particular interest is the John Day, Ore., site, which is located in the Blue Mountains, 20 miles southeast of John Day in the Malheur National Forest and is nearest to the current study area. The stand was composed of large ponderosa pine (20-60 trees > 21 inches DBH/acre) and 800-8,000 stems of suppressed ponderosa and lodgepole pine less than six inches DBH. The prescription called for thinning trees ranging in size from saplings 1.5 feet in height to trees 9 inches DBH or less within 30 feet of large (> 21 inches DBH) ponderosa pine trees.

The main treatment impacts on fire risks and stand resilience include:

- Increased canopy base height, improving stand resistance to crown fire initiation
- Increased average stand height without a significant increase in fuel bed depth.

Figure A-3 shows pre-treatment stand conditions at the Blue Mountain trial site near John Day. Note the large number of stems and buildup of live biomass in the understory.

Figure A-3. Blue Mountain pre-treatment stand conditions

Figure A-4 shows post-treatment conditions at the Blue Mountains trial location. The Spyder 4-wheeled excavator was demonstrated at this site. This system has a mastication head with guarded blades. Note that this system distributes debris evenly along the surface floor without significantly increasing the surface fuel profile.

Figure A-4. Blue Mountain post-treatment Spyder stand conditions

Equipment productivity and cost

Equipment productivity and costs were estimated for each trial. Time and motion study data were collected on one day for each trial using accepted methodology. The production cycle of each system was broken down into activities such as travel, cut or process. The set of activities for a system was unique to the functions of that system. The authors used the standard methods to calculate hourly machine costs. The study's final report documents all assumptions, but overall assumptions included:

- Initial costs used were the mean of the ranges given in the system descriptions
- Machine life of five years
- Operating season of 1600 hours/year
- After five years the owner would expect to receive 20% of the purchase price for the equipment (salvage value)
- Interest cost is 10% of the average annual investment
- Insurance cost is 2% of the average annual investment
- Property tax cost is 3.4% of the average annual investment
- Fuel cost is $1.25/gallon
- Operator wages plus benefits is $20/hour
- Profit and risk is 15% of owning and operating costs, excluding labor
- All production costs ($/acre) are calculated based on 800 stems to treat per acre

Table A-11 lists the equipment costs and productivity for each system employed in the field trials. The final report describes in more detail the relative advantages and disadvantages of each system for various stand conditions. Overall, the authors noted that mastication systems with knives (e.g., Promac, Spyder) may be faster in dealing with trees less than three-inches DBH, while the mastication system with fixed teeth on a rotating wheel (Nordstrom, Unnamed Mastication System) may be faster and more efficient when treating larger trees greater than six inches DBH. The location of the biomass to be treated affects the choice of which system is most appropriate. For treating fuel loads on the ground, a mastication system with a horizontal drum (Fecon, Merri Crusher) is more appropriate than a head mounted on the end of an excavator boom (Nordstrom, Unnamed Mastication System, Spyder, Promac).

Table A-11. System hourly costs, production rates, and production costs

System	Cost/ hour	Hours/acre		Acres/8-hour day		Cost/acre	
		Low	High	Low	High	Low	High
ATV with Forwarding Arch	$23.89	32	50	0.2	0.3	$756	$1,194
CTL (Timberjack)	$228.13	3	5	1.7	2.5	$675	$944
CTL (Kobelco, Timberjack)	$184.78	6	8	1.0	1.3	$799	$999
ASV (cut and skid, two machines)	$92.37	8	9	0.9	1.0	$493	$677
ASV (cut, skid, and masticate, one machine)	$46.18	14	19	0.4	0.6	$640	$899
Yarder – Government	$42.98	23	35	0.2	0.4	$967	$1,504
Yarder - Contractor	$194.39	5	11	0.7	1.8	$875	$2,187
Fecon (ASV- mounted)	$54.07						
Fecon (excavator- mounted)	$68.69	6	10	0.8	1.3	$440	$659
Fecon (RT400- mounted)	$90.46	6	10	0.8	1.3	$579	$868
Unnamed Mastication System	$67.33	6	13	0.6	1.3	$431	$862
Promac	$68.69	5	8	1.0	1.7	$330	$550
Nordstrom	$125.84	3	6	1.3	2.5	$403	$805
Bandit (with harvester and rubber-tired skidder)	$248.34	2	3	2.5	3.3	$428	$672
Spyder	$85.40	6	8	1.0	1.3	$547	$683
Hakmet	$136.08	14	26	0.3	0.6	$1,265	$2,094

Table A-12 shows the equipment configurations used at the Blue Mountains site.

Table A-12. Equipment Configurations used at John Day Trial Location

System	System cost	Contact
Hakmet	$20,000-$30,000 Felling head $50,000-$70,000 Excavator $20,000-$30,000 Merri Crusher $70,000-$90,000 crawler tractor	Hakmet USA, Inc., Reijo "Ray" Ulmonen Phone: 800-566-0690, 530-224-1397 Cell: 530-515-8423 Fax: 530-224-1398 E-mail: kakmetus@jett.net Web: www.hakmetusa.com
Unnamed Mastication System	$35,000-$50,000 Mastication head $110,000-$130,000 excavator	None
ATV w/ Forwarding arch	$1,500 Forwarding arch $3,000 - $7,000 ATV	Future Forestry Products Mark Havel, Willamina, Ore. Phone: 1-888-258-1445 Web: www.futureforestry.com E-mail: contact@futureforestry.com
All surface vehicle (ASV) w/multiple attachments	$60,000-$80,000 ASV $8,000-$10,000 shear $5,000-$10,000 hot saw $5,000-$7,000 mastication system $3,000-$5,000 delimber $5,000-$7,000 grapple	Grouse Mountain Tractor, Byron Haberly, John Day, Ore. Phone: 541.575.2908 Web: www.ASVI.com
ASV with shear, Bobcat skid steer with grapple	$60,000-$80,000 ASV with shear $60,000-$80,000 Bobcat with grapple	Deschutes National Forest, Sisters Ranger District, Dave Moyer Phone: 541-549-7718 Cell: 541-549-7700 Email: dmoyer@fs.fed.us
Spyder 4-wheeled excavator	$290,000	Kemp West, Inc. (Kaiser Spyder) Phone: 425-334-8253 Cell: 425-508-4609 Fax: 425-334-5366 email: kari.hasko@get.net

Fire risk and fuels impacts

Fire risk and fuels impacts of treatment were examined in the study. To determine fire risk and fuels impacts, pre- and post-treatment stand conditions were modeled using the FMAPlus Program (http://www.fireps.com/fmanalyst/). The fuel model results showed that pre-treatment stand conditions at most trial locations did not pose a serious risk of either passive or active crown fire. In Washington, the Okanogan/Wenatchee pre-treatment stand exhibited conditions that showed passive crown fire when 20-foot wind speeds increased by three miles/hour to 13 miles/hour.[123] The majority of the systems showed negligible soil impacts, with the exception of systems designed to incorporate biomass into the soil.

Table A-13 shows the results of the fuels modeling for the John Day field trials.

[123] Coulter, et al., 32

Table A-13. Blue Mountain fuel model results

System	Crown Base Height (ft)	Change in Crown Base Height (ft)	Basal Area (ft^2/ac)[a]	Fire Type	Rate of Spread (ch/hr)[b]	Flame Length (ft)	Average Stand Height (ft)
Pretreatment	3		143.71	Surface	1.1	0.8	23
Hakmet	32	29	203.91	Surface	2.1	1.4	65
Unnamed Mastication System	51	48	203.91	Surface	2.1	1.4	79
ATV	81	78	330.27	Surface	4.4	2.1	63
ASV	50	47	64.51	Surface	1.1	0.8	103
Spyder	22	19	10.05	Surface	2.1	1.4	65

[a] Square feet/acre
[b] Chains/hour. A chain is a U.S. survey unit that is the equivalent of 66 feet (20.1 meters)

In all but two cases, the post-treatment stand conditions did not support active or passive crown fires. In the two exceptions (Idaho City Bandit and Okanogan/Wenatchee Fecon treatments), the model showed that post-treatment conditions were conducive to passive crown fire.

The results show a significant increase in both crown base height and stand height for each harvesting system demonstrated. The model results in Table A-13 show slight increases in rate of fire spread and flame length in the post-treatment stands for trials that used mastication systems, which the authors attribute to that fact that in the post-treatment stands, what had once been vertical biomass was now distributed on the forest surface.[124] In the majority of the treatment areas, there was not a significant increase in the forest surface vertical fuel profile.

The increase in fire spread and flame length in the post-treatment stand, combined with an increase in canopy base height, suggest that while a fire in the post-treatment stand may move slightly faster than in the pre-treatment condition, there is less likelihood of a passive or active crown fire since the fire itself will remain near the forest surface. The changes in flame length and fire spread should be considered in light of the fact that the pre-treatment stand did not pose a large risk of active or passive crown fire. A more significant comparison could be made between a pre-treatment stand at greater risk of crown fire and a post-treatment stand thinned to a similar characteristic as the trial location.

Figure A-5 shows the changes in canopy base height between pre- and post-treatment stands.

[124] E. Coulter, K.Coulter, T. Mason, J. Szymoniak and L. Swan, *Dry Forest Mechanized Fuels Treatment Trials Project* (Central Oregon Intergovernmental Council, October 24, 2002, http://www.theyankeegroup.com/mechfuels/), p. 32.

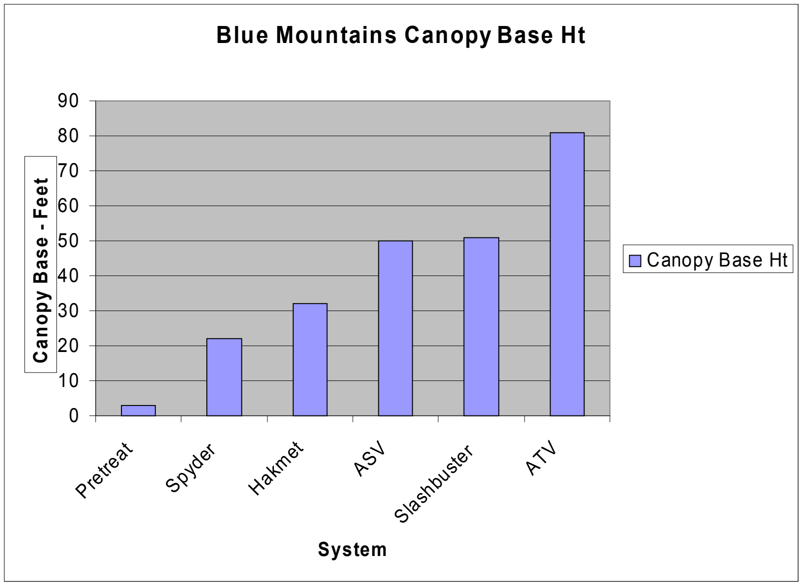

Figure A-5. Blue Mountain canopy base height difference

The ATV system produced the largest change in canopy base height, followed by the ASV systems, Hakmet system and Spyder system.

Extractive systems (e.g., ATV, ASV/Skid Steer systems) reduced the potential crown percentage scorched and risks of tree mortality. Extractive systems left debris in piles or in skid trails, while mastication systems distributed debris evenly across project sites.[125]

Soil impacts

Treatment impacts on soil resources were estimated using a visual soil assessment protocol created by Weyerhaeuser and later adapted by Steve Howes, USFS Soils Program Manager for Washington and Oregon. The soil disturbance class values range from "0" to "6." Increasing values represent greater levels of soil disturbance. The values shown in Table A-14 show the percentage of observations within each disturbance class at the John Day site.

Table A-14. Soil impact summary for the John Day site

Disturbance Class	Pre-Treatment	Unnamed Mastication System	ASV	ATV	Hakmet	Spyder
0- Undisturbed	0%	0%	0%	5%	0%	0%
1 – Slight disturbance	33%	43%	50%	86%	14%	21%
2 – Some disturbance	0%	52%	43%	9%	36%	79%
3 – Moderate disturbance	67%	4%	7%	0%	50%	0%
4 – High disturbance	0%	0%	0%	0%	0%	0%
5 – Severe disturbance	0%	0%	0%	0%	0%	0%
6 – Altered drainage	0%	0%	0%	0%	0%	0%

125 Ibid., p. 33.

Discussion

The fire model results did not present definitive support for the effectiveness of the mechanical thinning treatments in reducing initiation of active and passive crown fire. In part, this is because of an issue with the choice of trial locations. The fuel model results for the pre-treatment stands showed that there was no serious risk of either active or passive crown fire at any of the trial locations. Only the fire model results for the Okanogan/Wenatchee pre-treatment stand conditions showed a likelihood of active or passive crown fires, and then only in the case of stronger wind speeds. The fuel model results show that the post-treatment stand conditions are not, in most cases, likely to support active or passive crown fires. However, this only supports the assertion that mechanical thinning is not likely, under most circumstances, to exacerbate crown fire risks. Without pre-stand conditions that show evidence of the likelihood of supporting active or passive crown fires, the effectiveness of mechanical treatments in reducing fire risks at these locations cannot be determined.

The result showing that the treatments increased canopy base height suggest that the treatments were likely to reduce the risk of initiation of crown fires. In addition, other studies conducted throughout the western U.S. support the effectiveness of mechanical thinning in the reduction of crown fire risks.

Using the fire model to compare the results of fire behavior in pre- and post-treatment stands under elevated wind speeds would supplement the study results by showing the effectiveness of the treatments in preventing crown fires in conditions of elevated wind speed. It has been shown that wind speed is an influential factor in the spread of crown fires in the western U.S. In addition, selection of pre-treatment stands that exhibit conditions that are supportive of active or passive crown fires could provide more information about the effectiveness of stand treatment in preventing crown fires.

3. OREGON CELLULOSE-ETHANOL STUDY

This section summarizes some of the major findings of the Oregon Cellulose-Ethanol Study, which was completed in June 2000. This Appendix draws from material presented in the final project report.[126] The study reviewed policies that support ethanol industry development, resource availability, cellulose-ethanol technology and economic viability of ethanol manufacturing.

At the time of publication of the study, ethanol was used primarily in EPA oxygenated fuels program areas, including the Portland Metropolitan Area, Klamath Falls and Medford. The oxygenated fuels plan remained in place in Portland because of a state comprehensive air quality plan, even though Portland was reclassified in 1997 as “in-attainment” for EPA air quality standards. The Federal Highway Administration estimated ethanol use in Oregon to be 13.9 million gallons in 1998, though some fuel marketers reported that actual ethanol use may be twice that amount. At the time of the study, there were no ethanol production facilities in Oregon. Most ethanol used in the state comes from the Midwest or the Caribbean.

Some of the policy justifications cited in the study for promoting the production of ethanol from cellulose materials in Oregon included waste reduction, sustainable economic development, greenhouse gas mitigation and provision of a viable alternative to MTBE as an oxygenate for reformulated gasoline. By using waste resources to produce ethanol, Oregon would have an in-

[126] A. Graf and T. Koehler, *Oregon Cellulose-Ethanol Study* (Oregon Department of Energy, June 2000).

state source of renewable fuels and would keep dollars in the state, rather than sending them to out-of-state ethanol manufacturers. Cellulose ethanol manufacturing would likely have a positive effect on rural areas of the state, where economic development needs are most pressing.

The viability of the cellulose ethanol industry depends on the status of cellulose ethanol technology but also on future gasoline and ethanol markets. Cellulose ethanol technology has not yet been demonstrated on a commercial scale, with the exception of one plant that uses sugars from liquid residues from pulp operations. The authors cited a report from the Energy Information Administration that estimated cellulose ethanol manufacturing costs would range from $1.15 to $1.43 per gallon but that technology advances could reduce this cost to $0.69 to $0.98 per gallon over the next two decades. This could make ethanol cost-competitive with wholesale gasoline. Ethanol costs are also dependent on biomass resource costs and availability.

The study found that the biomass resource in Oregon could support a substantial cellulose ethanol industry. More than 8.5 million oven dry tons (ODT) of biomass were generated in 1998 in Oregon, according to estimates provided in the study. This quantity was a gross figure. Some portion of this quantity would not be available for use. However, if it were possible to utilize all of this material, the biomass resource could be used to produce more than 500 million gallons of ethanol per year. The study found that the economically recoverable resource was sufficient to support about 170 million gallons of ethanol manufacturing per year, not including forest residues. If forest residue could be cost-effectively and dependably removed, total potential ethanol production would increase to a total of 364 million gallons per year. In any of these resource scenarios, the resource would support production of all of Oregon's fuel ethanol requirements (based on 1998 usage) and would provide additional ethanol to meet growing ethanol demand in other states.

Agricultural residue, the largest component, represented approximately 49% of the estimated biomass resource, forest residue made up 35%, municipal solid waste (MSW) made up 15% and other sources made up the remaining 1% of the estimated resource.

The total quantity of agricultural residue generated in Oregon could be used to produce over 200 million gallons of ethanol each year (see Table A-15). However, not all of this residue was considered available for ethanol production.

Table A-15. Agricultural residue generation and ethanol potential in Oregon

Residue type	Land area planted (Acres)	Conversion factor (ODT/acre)	Total generation (ODT/year)
Nurseries/Greenhouses	38,100	1	38,100
Grass Seed	461,900	2.1	969,990
Wheat	885,000	2.3	2,035,500
Hay	970,000	0.3	291,000
Potatoes	58,000	1.2	69,600
Pears	17,800	2.3	40,940
Onions	19,500	1	19,500
Cherries	11,000	0.4	4,400
Mint	42,000	1	42,000
Hazelnuts	29,100	1	29,100
Apples	29,100	2.2	64,020
Sweet corn	8,700	4.7	40,890
Beans	95,060	1	95,060
Barley	130,000	1.3	169,000
Oats	54,000	1.2	64,800
Sugar beets	17,500	2.4	42,000
Grapes	7,100	1	7,100
Strawberries	4,440	0.3	1,332
		Total (ODT/year)	**4,024,332**
		Estimated total ethanol potential (Gallons/year)	**201,200,000**

The composition of the statewide biomass resource from the Oregon Cellulose-Ethanol study was similar to the results for the current study in that wheat straw, grass straw and oats are primary constituents of the resource. Hay was not evaluated for the current study, as it was not a major crop in Northeast Oregon.

Table A-16 provides Oregon Department of Environmental Quality data for the biomass components of MSW generated in Oregon in 1998. MSW was not included in the biomass resource assessment for the current study. However, estimated annual biomass fraction of MSW generation for Baker, Union and Wallowa Counties totals 6,184 ODT per year, based on the figures in Table A-16. This relatively small quantity could supplement agricultural and forest biomass in larger biomass energy applications, or it could be used in smaller facility-heating applications.

Table A-16. Cellulosic biomass fractions from MSW recovered in Oregon

County	Maga-zines	Cardboard/ Kraft paper	Phone books	High grade paper	Newspaper	Mixed waste paper	Total paper	Wood waste	Yard debris	Total all
Baker	97.9	993.5	-	35.0	207.8	85.3	1,419.6	14.6	602.8	2,037.0
Benton	25.4	6,381.7	3.5	1,145.4	2,988.3	2,724.2	13,268.5	2,527.5	11,267.2	27,063.1
Clatsop	203.6	2,710.4	4.4	352.0	1,004.4	13.1	4,287.9	322.0	1,338.1	5,948.0
Columbia	146.5	2,054.9	-	1,630.8	658.2	484.4	4,974.8	1,566.4	8.8	6,550.0
Coos	341.8	4,449.5	-	95.5	1,444.8	271.1	6,602.7	1,993.0	875.8	9,471.6
Crook	-	643.1	3.1	42.4	266.8	-	955.5	481.5	-	1,437.0
Curry	93.8	1,522.9	10.0	21.3	532.1	92.3	2,272.4	-	-	2,272.4
Deschutes	714.9	8,226.0	52.4	570.7	2,816.6	253.0	12,633.6	15,979.5	8,726.4	37,339.5
Douglas	312.1	5,475.2	26.4	371.1	1,679.6	183.8	8,048.3	8,799.7	12,058.6	28,906.5
Gilliam	2.8	54.1	-	2.0	39.6	2.7	101.2	-	-	101.2
Grant	11.0	179.4	-	28.0	64.8	5.8	289.0	14.6	-	303.7
Harney	-	197.5	-	10.3	76.7	0.3	284.8	296.2	-	581.1
Hood River	74.8	1,224.9	6.7	47.3	335.8	-	1,689.6	-	55.8	1,745.4
Jackson	514.8	14,427.1	112.8	1,006.8	4,391.5	371.7	20,824.8	25,891.0	13,427.5	60,143.3
Jefferson	17.6	668.6	3.0	40.4	185.4	-	915.0	2,305.5	-	3,220.6
Josephine	4.6	4,013.7	50.5	583.5	1,944.4	10.9	6,607.6	8,247.7	5,119.8	19,975.1
Klamath	52.7	2,664.6	-	238.6	974.9	149.0	4,079.8	2,097.5	2,305.5	8,482.7
Lake	-	135.5	-	7.2	1.4	-	144.1	-	2.5	146.6
Lane	423.0	30,560.7	118.1	5,500.3	13,251.0	8,210.2	58,063.3	49,501.4	20,706.8	128,271.4
Linn	682.2	7,731.3	0.0	1,018.9	4,127.1	1,440.6	15,000.1	4,947.1	8,549.9	28,497.2
Lincoln	127.3	3,782.1	0.1	94.3	1,271.9	1,318.6	6,594.4	59.1	375.1	7,028.6
Malheur	100.2	3,072.1	-	72.1	527.6	-	3,772.0	90.0	-	3,862.0
Metro	20,170.0	179,220.4	1,784.3	51,132.3	98,849.2	59,356.1	410,512.3	176,069.8	148,756.5	735,338.6
Milton & Freewater	11.1	485.8	0.1	23.8	124.8	22.1	667.6	22.0	160.0	849.6
Marion	956.6	19,361.0	155.8	4,008.6	8,401.3	3,019.3	35,902.4	17,854.6	25,887.3	79,644.4
Morrow	-	660.8	-	9.1	101.7	-	771.6	-	-	771.6
Polk	301.6	3,591.2	22.8	651.4	2,136.0	221.3	6,924.3	493.0	3,260.8	10,678.1
Sherman	22.8	48.6	1.0	5.1	59.3	-	136.7	-	-	136.7
Tillamook	106.7	1,105.2	-	39.6	841.1	23.5	2,116.0	-	0.2	2,116.3
Umatilla	103.1	6,661.6	2.5	113.0	759.7	221.6	7,861.5	1,577.4	459.6	9,898.5
Union	181.5	1,886.9	-	35.6	356.8	267.4	2,728.1	539.6	645.0	3,912.8
Wallowa	-	159.6	-	7.0	61.6	-	228.3	2.0	4.0	234.3
Wasco	90.6	1,704.3	-	36.1	698.1	38.9	2,568.0	1,282.5	1,927.0	5,777.5
Wheeler	2.1	23.8	-	1.5	6.0	-	33.4	10.9	7.3	51.7
Yamhill	449.4	5,419.9	10.1	472.3	2,826.8	21.9	9,200.4	3,701.5	12,221.8	25,123.7
Totals	26,342.4	321,498.1	2,367.6	69,449.3	154,013.1	78,809.1	652,479.7	326,687.7	278,750.1	1,257,917.5

Source: A. Graf and T. Koehler, *Oregon Cellulose-Ethanol Study* (Oregon Department of Energy, June 2000), p.16.

Estimates of biomass generation were also developed on a regional level for Oregon. Figure A-6 shows the areas used in the breakdown of regional biomass availability in Oregon. The Eastern Oregon region for this study extends from the north all the way to the southern border of the state and includes Wallowa, Union and Baker Counties.

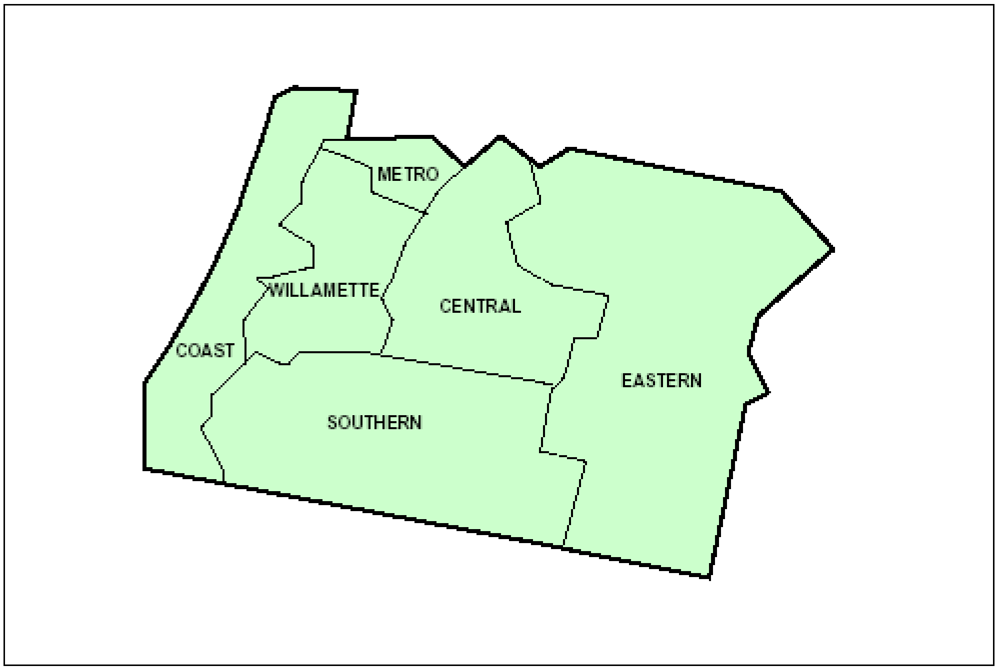

Figure A-6. Regional breakdown for biomass resource estimation

Table A-17 provides estimates of regional biomass generation in Oregon based on the regions delineated in Figure A-5. These estimates exclude biomass potentially recoverable from forest thinning activities.

Table A-17. Estimated feedstock potential by region (ODT/year)

Feedstock	Coast	Willamette	Metro	Central	Eastern	Southern
Mixed waste paper	26,848	138,359	412,203	18,115	6,583	39,705
Yard debris	3,941	79,025	176,070	20,060	2,535	45,036
Green waste	0	148,812	10,661	1,711	0	2,598
Wheat straw	0	81,894	0	0	2,100,000	32,914
Grass straw	0	1,000,000	0	0	0	0
Paper sludge	73,584	91,980	18,396	0	0	0
Total	**106,971**	**1,391,258**	**755,481**	**48,836**	**2,110,829**	**117,655**

Note: Other agricultural residue is not shown. In addition, there are an estimated 2.9 million tons of forest thinnings potentially available. However, further research is necessary to determine the location and amounts of recoverable thinnings.

APPENDIX B. BIBLIOGRAPHY OF BIOMASS STUDIES

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APPENDIX C. BIOMASS ESTIMATE TABLE

Table C-1. Estimated annual forest biomass generation (GT/year) – High and low values reflect variability in annual management intensity

Landowner/ treatment type	Fuels reduction yield 10 GT/acre			Fuels reduction yield 5 GT/acre			Fuels reduction yield 15 GT/acre		
	Avg.	High	Low	Avg.	High	Low	Avg.	High	Low
USFS									
Fuels treatment[a]	42,405	66,940	17,870	21,203	33,470	8,935	63,608	100,410	26,805
Non-commercial thinning[b]	33,710	35,670	31,750	16,855	17,835	15,875	50,565	53,505	47,625
TSI [b]	79,120	94,900	61,980	39,560	47,450	30,990	118,680	142,350	92,970
Timber residues	99,447	176,432	53,468	99,447	176,432	53,468	99,447	176,432	53,468
State									
Timber harvest residues	1,247	2,015	392	1,247	2,015	392	1,247	2,015	392
Industrial private									
Timber residues	176,027	239,988	117,329	176,027	239,988	117,329	176,027	239,988	117,329
Fuels treatment	16,402	6,561	24,603	8,201	3,280	12,302	24,603	9,841	36,905
Nonindustrial private									
Timber residues	100,509	155,968	38,517	100,509	155,968	38,517	100,509	155,968	38,517
County/municipal									
Timber residues	694	2,086	19	694	2,086	19	694	2,086	19
Totals									
Fuels treatment, non-commercial thinning	92,517	109,171	74,223	46,259	54,585	37,112	138,776	163,756	111,335
TSI	79,120	94,900	61,980	39,560	47,450	30,990	118,680	142,350	92,970
Timber residues	377,925	576,488	209,725	377,925	576,488	209,725	377,925	576,488	209,725
Total - all sources	549,562	780,559	345,928	463,743	678,524	277,826	635,380	882,595	414,029

[a] Source: U.S. Forest Service, GEOMAC National Fire Plan Maps. On-line: http://wildfire.geomac.gov/NFPmaps/viewer.htm?extent=Oregon. Accessed March 19, 2003. 2000 -2001 National Fire Plan Fuels Reduction Project data for Congressional District 4102.

[b] U.S. Forest Service Monitoring Reports for Wallowa-Whitman and Umatilla National Forests: 1998-2000.

APPENDIX D. LIST OF POTENTIAL CONVERSION SITES

County	Site notes	Include as site?	Site name	Address	City	Lat	Lon
Baker	Too far from forested areas	N	Ash Grove Cement Co.	33060 Shirt Tail Creek Rd.	Durkee	44.32000	(117.24550)
Baker	In urban boundary	N	Behlen Manufacturing	4000 23rd St.	Baker City	44.79498	(117.85791)
Baker	Not enough information	N	Bourne Mining Corporation - Cracker Creek Gold Mine		Bourne	44.83167	(118.20000)
Baker	Next to airport	N	Farwest Concrete	Airport Lane	Baker City	44.78010	(117.82863)
Baker	Not enough information	N	Northwest Pipeline Corporation			44.79841	(117.73607)
Baker	In urban boundary	N	Triple C Redi Mix	42434 Attwood Rd	Baker City	44.78010	(117.82863)
Baker	Not enough information	N	UNC Cornucopia Mining CO, Inc.		Halfway	45.01022	(117.19500)
Baker	Good potential site	Y	Ellingson Lumber S. Baker		Baker City		
Baker	Prior cogen location (1980s	Y	Former Ellingson Lumber site	3000 Broadway	Baker City		
Baker	Rural site	Y	Former Ellingson Lumber site	38350 Sawmill Cutoff Rd	Halfway		
Union	In urban boundary but with rail access, industrial area, land availability questionable	N	Del Monte Corporation	1621 Spruce	La Grande	45.31660	(118.08130)
Union	1 mile south of La Grande on 84 - current use unknown	N	RD Mac	60831 McCalister Rd	La Grande	45.30787	(118.04508)
Union	Not enough information	N	Teague Mineral Products		Malheur	45.08000	(118.16190)
Union	Near airport	N	Union County Airport Industrial Site		La Grande		
Union	Too small	N	Union Industrial Park		Union		
Union	Near airport	N	USFS La Grande Air Tanker Base	60131 Pierce Rd	La Grande	45.28417	(118.00083)
Union	Not enough information	N	Western Farm Service/Crop Production Services Inc	64325 Booth Lane	La Grande	45.36300	(117.99920)
Union	Bought by ethanol develope	Y	Baum Industrial Park		La Grande		
Union	Yes	Y	Boise Cascade Elgin Complex	90 S. 21st St	Elgin	45.55667	(117.91278)
Union	Yes	Y	Boise Cascade La Grande Sawmill	Jackson and Willow St	La Grande	45.31472	(118.05167)
Union	Yes	Y	Boise Cascade Particleboard Island City	62621 Oregon Hwy 82	La Grande	45.32778	(118.02140)
Union	Yes	Y	Borden Chemical Co Inc	62675 Oregon Hwy 82	La Grande	45.35930	(118.00950)
Union	University	Y	Eastern Oregon State College	1 University Blvd	La Grande	45.31667	(118.08444)
Union	Maybe	Y	Elgin Industrial Park		Elgin		
Union	New industrial park	Y	Gelmekern Industrial Park		La Grande		
Union	Retired biomass power plant	Y	Idaho Timber Corporation		North Powder	45.05631	(118.04508)
Union	Shut down - no heat load	Y	North Powder Lumber Co.	105 2nd St	North Powder	45.03320	(117.90740)
Union	In urban boundary but with rail access, industrial area, land availability questionable	Y	Oregon Trail Electric Coop	2408 Core Ave	La Grande	45.32574	(118.06874)
Union		Y	Western Ag Services	Oregon Hwy 82	Alicel		
Wallowa	Very small bronze casting	N	Joseph Bronze	83365 Joseph Hwy	Joseph	45.36194	(117.25528)
Wallowa	Very small bronze casting	N	Parks Bronze	331 Golf Course Rd	Enterprise	45.43639	(117.28639)
Wallowa	Very small bronze casting	N	Valley Bronze of Oregon	307 W Alder	Joseph	45.36667	(117.16667)
Wallowa	Yes	Y	Bates mill site		Wallowa		
Wallowa	Yes	Y	Great Western Pellet Mill	708 Golf Course Rd	Enterprise	45.43370	(117.28940)
Wallowa	No sewer	Y	Joseph mill site		Joseph		
Wallowa	Yes	Y	Wallowa Forest Products LLC	Lower Diamond Prairie Rd		45.34000	(117.30460)

APPENDIX E. PERMITTED BOILERS IN STUDY AREA

Name	Manufacturer	Fuel	Capacity	Units	Use	Notes
Eastern Oregon University, La Grande						
21508	Cleaver Brooks	NG	25.1	MMBtu/hr	9 months	
21510	Cleaver Brooks	NG	25.1	MMBtu/hr	9 months	
41812	Kewanee	NG	3.35	MMBtu/hr	3 months	
41817	Kewanee	NG	0.95	MMBtu/hr	3 months	
67713	Lochivar	NG	0.5	MMBtu/hr	12 months	
2703	AO Smith	NG	0.9	MMBtu/hr	12 months	
28834	Aerco	NG	1	MMBtu/hr	3 months	
65463	PVI	NG	0.5	MMBtu/hr	12 months	
Boise Cascade, La Grande						
#1	Cleaver Brooks	NG	20.7	k#/hr	12 months	323.7 Mft3 NG/yr for all boilers
#2	Cleaver Brooks	NG	20.7	k#/hr	12 months	350 Mlb steam/yr all boilers
#3	Cleaver Brooks	NG	20.7	k#/hr	12 months	in 1997 had 11 hog fuel boilers
No name						1-10 dutch ovens 40k#/hr
No name						11 Stearling 12.5k#/hr
No name						
Joseph Timber, Joseph						
No name	ABCO	bark	15.9	k#/hr	6424 hrs	60.342Mlb#/yr
No name						installed 1978
No name						source tested July 2001
No name						rated at 25k#/hr
No name						
Marvin Wood Products, Baker City						
4 boilers		NG	2	MMBtu/hr /hr	17838hrs	hrs for all four boilers
No name						permit limit 18 Mft3/yr
Borden Chemical, Island City						
#1		NG & H2	20	k#/hr	7887hrs	41.662 Mft3 NG/yr
#2		NG	30	k#/hr	8688 hrs	18,193 tons H2/yr
Johnson Lumber, Wallowa						
No name	Wellons	hog fuel	16	k#/hr		20.9 MMBtu/hr fuel input
No name						installed 1991
No name						78 M#/yr in 2002
No name						former Wallowa Forest Prod
No name						source tested 1999 7,700 #/hr
No name						1997 burned 14k hog fuel
Boise Particle Board, Island City						
#1		NG/sander dust	28	k#/hr		162M#steam/yr
#2		NG/sander dust	28	k#/hr		
Boise Elgin						
#1		hog fuel				332,503 M lb steam/yr
#2		hog fuel	50.941	k#/hr		303,751 M lb steam/yr
No name						# 2 source tested 9/18/02

Source: Oregon Department of Environmental Quality. Note: k#/hr = thousand lb/hour, M lb = million lb, Mft3 = million cubic feet, NG = natural gas

APPENDIX F. SUSTAINABILITY FOCUS GROUP MATERIALS

AGENDA

Date:	**November 21, 2002**
Time:	**12 PM to 5 PM**
Location:	**Grande Ronde Model Watershed Offices, La Grande, OR** **10901 Island Avenue La Grande, OR 97850 Phone: 541-962-6590**

12:00 – 12:10 Welcome and introductions

12:10 – 12:30 Project review (Scott Haase and Tim Rooney, McNeil; Jim Kerstetter, Consultant

Session 1: Forest biomass supply sustainability

12:30 – 1:00 Overview of forest sustainability criteria & indicators

This presentation will present an overview of forest management priorities and the results of existing efforts to evaluate forest sustainability in Northeastern Oregon.

1:00 – 2:30 Questions for discussion

- How can biomass utilization affect forest sustainability in Northeastern Oregon? *(review pros and cons in light of Montreal Process criteria and indicators, Forestry Program for Oregon objectives)*
- How can foresters optimize the benefits and minimize negative impacts of biomass collection and utilization? *(See Oregon Forest Practice Rules)*
- How can forested areas best be prioritized as candidates for treatment and biomass removal in Blue Mountains region? (*see Blue Mountains Demonstration Area Restoration Strategy*)
- What characteristics would exclude forested areas as candidates for management? (*see Blue Mountains Demonstration Area Restoration Strategy*)
- What legal, regulatory and economic issues affect the potential for biomass utilization? *(see Forestry Program for Oregon)*

2:30 – 2:45 Summary

2:45 – 3:00 Break

Session 2: Agricultural biomass supply sustainability

3:00 – 3:30 Overview of agricultural sustainability in Northeastern Oregon

This is an overview of agricultural practice standards, key issues for sustaining agricultural land in Northeastern Oregon, and potential economic and environmental impacts of biomass utilization.

3:30 – 4:45 Questions for discussion

- How does crop residue utilization affect agricultural sustainability in Northeastern Oregon? *(see Burn or bale: effect on biomass and nutrient and Farming with the Wind)*
- What site criteria limit the potential to collect and utilize crop residues (e.g., slope, soil type, water quality, soil erosion potential, soil productivity, crop cover type, residue yield)?
- What practices can producers use to optimize the benefits and minimize negative impacts of crop residue collection and use? *(See Farming with the Wind, Nitrogen uptake and utilization by Pacific Northwest Crops, Oregon NRCS Residue Management Practice Standard 344)*
- What legal, regulatory and economic issues affect the potential to collect and use crop residues?

4:45 – 5:00 Summary, conclusions and next steps

Recommended reading in preparation for focus group

Forest Biomass

Forest Restoration Strategies

- Blue Mountains Demonstration Area. BMDA Restoration Strategy. Joint project: U.S. Forest Service, EPA, NOAA, FWS, BLM and the Oregon Governor's Office. On-line at: http://www.fs.fed.us/bluemountains/docs/restoration_strategy.htm

Forest Policy

- Oregon Board of Forestry. Forestry Program for Oregon (1995 and draft 2003 version). On-line at: http://www.oregonforestry.org/fpfo/1995/default.htm
  (2003 version still under development)

Assessing Forest Sustainability

- Oregon Report on Montreal Criteria and Indicators. Oregon Department of Forestry. On-line: http://www.oregonforestry.org/sustainability/first_approximation_report.htm. (see also: Montreal Process Criteria and Indicators, under "National/international assessment of sustainability " heading in "References for additional information"). These Montreal Process criteria are a widely used basis for establishing a framework to discuss sustainability in forest and other resource management practices.

Agricultural Biomass

Crop Residue Utilization – Sustainability

- Douglas, Clyde L. Jr. and Stephen L. Albrecht. Burn of Bale: Effect on Biomass and Nutrients. In: Columbia Basin Agricultural Research Annual Report. Spec. Rpt. 1012, pp. 46-50. 2000. Oregon State University, in cooperation with USDA Agricultural Research Service, Pendleton, OR.
- Farming with the Wind, "Managing Soil Cover and Roughness" Chapter 4, soil loss ratio, wind erosion, estimating surface cover, residue retention and tillage, Northwest Columbia Plateau Wind Erosion/Air Quality Project, 2002. Online at: http://pnwsteep.wsu.edu/winderosion/index.htm
- Nitrogen Uptake and Utilization by Pacific Northwest Crops. On-line: http://eesc.orst.edu/agcomwebfile/EdMat/PNW513.pdf A Pacific Northwest Extension Publication. PNW 513.
- Oregon NRCS Residue Management Practice Standard 344. On-line: ftp://ftp.or.nrcs.usda.gov/pub/fotg/FOTG-Oregon/Section-4/Standards/344std.doc or for all Oregon NRCS Practice Standards: http://www.or.nrcs.usda.gov/fotg/sec4updated.htm

References for additional information

Oregon/regional information/ guidance on forest sustainability

Legal/regulatory/policy framework

- Oregon Forest Practices Act ORS 527. 610 - .770 & .990 - .992. On-line at: http://www.leg.state.or.us/ors/527.html
- Oregon Forest Practice Rules (legal authority taken from Oregon Forest Practices Act. On-line at: http://arcweb.sos.state.or.us/rules/OARS_600/OAR_629/629_tofc.html
- Assessing Forest Sustainability in Oregon. Brown, James, Oregon Department of Forestry. October 21, 2001. On-line at: http://www.oregonforestry.org/sustainability/symposium/brown_files/frame.htm
- Working Together To Facilitate Change: 2001 Pacific Northwest Community Forestry Public Lands Policy Organizing Meeting. Wallowa Resources and Sustainable Northwest. December 12-14, 2001. Portland, Ore. On-line: http://www.hfhcp.org/policy/121202.pdf

Regional assessments of sustainability

- 2001 Oregon Forest Sustainability Summit On-line: http://www.oregonforestry.org/sustainability/symposium/presentations_long.htm
- Forest Resources in Eastern Oregon – Developing tools for assessing disturbance, succession, and management opportunities into the future. Barbour et al. At 2001 Oregon Forest Sustainability Summit. On-line at: http://www.oregonforestry.org/sustainability/symposium/barbour_files/frame.htm

National/international assessment of sustainability

- Montreal Process Criteria and Indicators for the Conservation and Sustainable Management of Temperate & Boreal Forests. On-line at: (http://www.sustainableforests.net/C&I_workshops/Criteria&Indicators.htm)
- Roundtable on Sustainable Forest Management (http://www.sustainableforests.net/) – U.S. Federal government (12 agencies) working toward Winter 2002/2003 release of comprehensive "National Report on Sustainable Forests"
- USDA Forest Service Local Unit Criteria and Indicators Development Project (http://www.fs.fed.us/institute/lucid/)

Data sources

- Federal Geographic Data Committee Sustainable Forest Data Working Group http://www.pwrc.usgs.gov/brd/sfd.htm
- Interior Northwest Landscape Analysis System – developed by USFS PNW Research Station in cooperation with a wide group of scientists (http://www.fs.fed.us/pnw/lagrande/inlas/) – Uses Upper Grande Ronde watershed as a study area to assess succession and disturbance patterns under various policy and management regimes – builds on CLAMS project. Contact Pete Bettinger, OSU Department of Forest Resources 237 Peavy Hall Corvallis, Ore. 97331-5703 Phone: (541) 737-8549 E-mail: pete.bettinger@orst.edu
- Forestry Sciences Laboratory at Oregon State University (http://www.fsl.orst.edu/) Coastal Landscape Analysis and Modeling Study (CLAMS)
- USDA PNW Ecosystem Management Decision-making Systems. Knowledge Based Decision Support for Ecological Assessment http://www.fsl.orst.edu/emds/ - multiple data sources. Forest sustainability database/GIS data permit the Evaluation of forest ecosystem sustainability on a national and regional scale based on the criteria and indicators of the Montreal Process. Contact: Keith Reynolds – Corvallis Forest Sciences Lab, PNW Research Station, USFS. E-mail: kreynolds@fs.fed.us

Table F-1. Focus group attendees

Name	Affiliation	E-mail	Phone
Dale Case	Agriculture	sandridgeag@hotmail.com	541-663-1806
John Manwell	Boise Cascade Corp.	John_Manwell@bc.com	541-962-2045
Jim Kerstetter	Consultant	jimkerstetter@attbi.com	360-753-7433
Vernon Tritchka	Eastern Oregon Economic Development Group (EOEDG)	vernon@engineer.com	541-963-4433
Brett Brownscombe	Hells Canyon Preservation Council	brett@hellscanyon.org	541-963-3950
Lisa Dix	Hells Canyon Preservation Council	ldix@hellscanyon.org	541-963-3950
Scott Haase	McNeil Technologies, Inc.	shaase@mcneiltechco.com	303-273-0071
Tim Rooney	McNeil Technologies, Inc.	trooney@mcneiltechco.com	303-273-0071
Angie Johnson	Oregon Department of Forestry	ajohnson@odf.state.or.us	541-963-3168
Diane Partridge	Oregon Department of Forestry	dpartridge@odf.state.or.us	541-963-3168
Rick Wagner	Oregon Department of Forestry	rwagner@odf.state.or.us	541-963-3168
John White	Oregon Department of Energy	john.white@state.or.us	503-378-3194
Brett Kelver	Oregon Rural Action	brett@oraction.org	541-975-2411
David Whitson	Oregon Rural Action		541-663-1841
Shelley Cimon	Oregon Rural Action	scimon@oregontrail.net	541-963-0853
John Dick, Fiber Manager - Wallula Resources	PNW Fiber Procurement	johndick@bc.com	509-545-3299
Marc Rappaport	SED Inc.	marcrapp1@aol.com	503-891-1589
Ron Eachus	SED Inc.	re4869@attbi.com	503-361-0116
Joel Frank	Union County Economic Development	ucedcz@eoni.com	541-963-0926
Darrin Walenta	Union County Extension, Oregon State University	darrin.walenta@oregonstate.edu	541-963-1010
Judy Wing	USDA Forest Service	jwing@fs.fed.us	541-962-8515
Kurt Wiedenmann	USDA Forest Service	kwiedenmann@fs.fed.us	541-962-8582
Tom Burry	USDA Forest Service, LaGrande Ranger District	tburry@fs.fed.us	541-962-8537
Trish Wallace	USDA Forest Service, LaGrande Ranger District	plwallace@fs.fed.us	541-962-8553
Ken Rockwell	USDA Forest Service, Wallowa-Whitman National Forest	krockwell@fs.fed.us	541-523-1262
Victoria Rockwell	USDA Forest Service, Wallowa-Whitman National Forest	vrockwell@fs.fed.us	541-523-1255

APPENDIX G. STATE FARM WILDFIRE PROGRAM

State Farm's Wildfire Program:

Taking Steps to Protect the Property
and Lives of our Policyholders

Program Goals:

While wildfire risk has always been a part of the Arizona landscape, it has become an increasing hazard over the last several years due to drought conditions, record low snow pack, fuel buildup and growing development in the wildland urban interface. To address these concerns, State Farm created a program that will be implemented in Arizona, Nevada, New Mexico, Utah, Colorado, and Wyoming. It will:

1) Protect the homes, personal property and lives of our customers.
2) Create a safer environment for the fire and emergency officials who respond to wildfires.
3) Educate our customers who live in the interface areas about the dangers associated with wildfires and how they can better protect their property and themselves.
4) Reduce the potential for and severity of future financial losses caused by these types of tragedies.

State Farm's hope is not to lose any customers because of the program.

Wildfire Program Details:

Over the next three years, 22,000 homes within the states of Arizona, Nevada, New Mexico, Colorado, Utah, and Wyoming will be surveyed. The surveyors will conduct an outside inspection of the home to identify whether or not any additional steps need to be taken to help better protect the property from future wildfires.

The homes were selected because they are in the highest hazard wildfire prone areas. This was determined by a combination of factors: vegetation or fuels, topography (slope and aspect), population density, lightning strike density, and the proximity of roads and railroads.
Each homeowner in the areas State Farm has identified as part of the program will receive a letter approximately one to two weeks prior to the survey, making him or her aware that it is going to take place. Because the survey is exterior only, the homeowner is not required to be on site.

During the survey, the vendor will identify possible hazards on the property. If the steps necessary to fix the hazards are minor in nature, we will send a letter to the customer approximately two to four weeks following the inspection, listing the items to address and notifying the homeowner that he or she has up to two years to correct those items.

If the property requires significant measures to address the hazards, we will send the customer a letter asking that he or she contact local fire officials to arrange to have an expert visit the property and develop a plan to better protect his or her property. The letter will also advise the customer that he or she will have 18-24 months to obtain the plan and complete the items noted on the plan. Any charges assessed for the help of a local fire or emergency management official is the responsibility of the customer.

Our customer's State Farm agent will follow-up to verify that the recommended measures are completed or are underway. If a homeowner chooses not to complete these safety measures, putting his or her property and the lives of fire officials at greater risk, we would look at options including the non-renewal of his or her property.

QUESTIONS AND ANSWERS:

Q. Is State Farm surveying all of the homes you insure in the wildfire areas?

A. No, we are surveying only a percentage of the homes we insure in the wildfire areas. We are concentrating on those homes in the highest hazard wildfire areas in Arizona, Nevada, New Mexico, Colorado, Wyoming and Utah.

Q. Will State Farm cancel the insurance of customers who refuse to complete the recommended mitigation work?

A. We hope that working with these customers in the highest hazard wildfire areas over the period of 18-24 months will encourage them to take the appropriate action on their property. However, if some refuse to do any work, putting his or her property and life at risk, as well as the lives of local fire officials, we would look at options to address the situation, including non-renewal.

Q: Who will pay for any charges assessed by local fire or emergency officials asked by a State Farm customer to survey the property and create an extensive plan to better protect the property?

A: Any payments for these or other related services would be the responsibility of our customer.

Q. What if one of your customers cannot afford to do the work?

A. There are many national, state and local grants and cost-share programs that may be able to provide funds to homeowners or communities. Many of these can be found by calling the local district office of the state forest service or a local fire authority. These offices also have lists of FireWise contractors who can be contacted regarding their services.
For additional information about the program, please contact Jordan Marsh at (480) 293-6520. Media inquiries should be directed to May Hendershot at (970) 395-5401.

APPENDIX H. SUMMARY OF BIOMASS INCENTIVES

1. FEDERAL BIOMASS HEAT AND POWER INCENTIVES

Section 45 - Renewable Energy Production Tax Credit

Section 45 of the Internal Revenue Code permits taxpayers to take a credit of 1.5 ¢/kWh for electricity generated from "closed-loop biomass" projects, adjusted periodically for inflation. In 2003, the tax credit amount was 1.8 ¢/kWh. In the fall of 1999, Congress amended Section 45 to let facilities using poultry waste for energy take advantage of the tax credit. The new rule also extended the "placed-in-service" date for qualifying facilities to December 31, 2003.[127]

The proposed Energy Policy Act of 2003 included a provision that would open the biomass credit to allow existing and new biomass plants to claim the credit for using biomass resources such as forest thinnings and mill residue and extend the eligibility date for facilities. However, Congress had not approved this legislation as of the date of this report.

Renewable Energy Production Incentive (REPI)

Section 1212 of the 1992 Energy Policy Act allows DOE to make incentive payments, adjusted annually for inflation, for electricity generated and sold by qualifying facilities. Qualifying facilities are eligible for annual incentive payments of 1.5 cents/kilowatt-hour expressed in 1993 dollars and indexed for inflation for the first ten year period of their operation, subject to the availability of annual appropriations in each Federal fiscal year of operation. The REPI authorizes direct payments to project owners from annual Congressional appropriations. Payment depends on availability of funds.

Qualifying electric production facilities are those owned by state and local government entities (such as municipal utilities) and not-for-profit electric cooperatives that started operations between October 1, 1993 and September 30, 2003. Provisions to extend this credit were contained in the Energy Policy Act of 2003, but Congress had not approved the legislation as of the date of this report. Qualifying facilities must use solar, wind, geothermal (with certain restrictions as contained in the rulemaking) or biomass (except for municipal solid waste combustion) generation technologies. Additional criteria for qualifying facilities and application procedures are contained in the rulemaking for this program.

The regulations for the administration of the REPI program are contained in Title 10 to the Code of Federal Regulations, Part 451 (10 CFR 451). The final rulemaking, which contains clarifying supplementary information, is contained in 60 CFR 36959.

Although the REPI is comparable in amount to the Section 45 production tax credit, congressional appropriations have not been adequate to fully fund payments to qualifying facilities. Because of this uncertainty, developers have been cautious in counting on REPI payments when assessing project economics.

Additional information on REPI can be found at: http://www.eere.energy.gov/power/repi.html.

[127] North Carolina Solar Center, *DSIRE: Renewable Energy Production Credit* at: http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=US13F&State=Federal&currentpageid=1

Special Depreciation Rules for Biomass Energy Facilities

Short depreciation lives are available for certain biomass energy facilities. A five-year tax life applies to biomass power facilities with a capacity of 80 megawatts or less. [128] A seven-year tax life applies to property used in biomass conversion to a solid, liquid or gaseous fuel.[129]

Tax-Exempt Financing

Assuming that the facility has more than 10% private business use, a biomass project can qualify for tax-exempt financing if it fits into one of two categories: 1) the project supplies gas or electricity to an area no larger than two contiguous counties or one city and a contiguous county, or 2) the facility is a solid waste disposal facility.[130]

Sulfur Dioxide Emission Allowances

The Clean Air Act Amendments of 1990 allow public utilities to receive one emission allowance per ton of SO_2 emissions avoided through energy efficiency or renewable energy projects. This program includes a bonus pool of emissions allowances to reward utilities for new renewable energy projects. Co-firing biomass with coal is one way that utilities can reduce SO_2 emissions from coal-fired power plants and qualify for emissions allowances.[131]

Carbon Offsets

The Energy Policy Act of 1992 contains provisions that allow public utilities to voluntarily report actions taken to reduce or sequester greenhouse gas emissions.[132] The U.S. Climate Leaders Program (http://www.epa.gov/climateleaders), sponsored by the EPA, provides industry with tools to help them reduce greenhouse gas emissions. Biomass energy projects are one way in which companies can reduce greenhouse gas emissions.

Green tag credit

Green tag values are not a government incentive but are instead based on market conditions and negotiated agreements between the buyer and seller. Values for green tag transactions range from $0.001/kWh to $0.04/kWh. For additional information on green tags, see: http://www.resource-solutions.org/TRCs.htm.

2. FEDERAL ETHANOL INCENTIVES

Federal Regulatory Programs Requiring Ethanol Use

Federal regulatory requirements for cleaner burning fuels have played a significant role in developing ethanol markets. In addition, these requirements have resulted in tax incentives being developed to help alleviate the costs of complying with federal air quality regulations. For these

[128] U.S. Department of Energy, Energy Efficiency & Renewable Energy, Biopower Program, *Biopower – Policy – Federal Tax Credits* (http://www.eere.energy.gov/biopower/policy/po_ftc.htm#ftc1).
[129] Oregon Department of Energy, *Biomass Energy Incentives* (http://www.energy.state.or.us/biomass/Incentive.htm).
[130] U.S. Department of Energy, Energy Efficiency & Renewable Energy, Biopower Program, *Biopower – Policy – Federal Tax Credits* (http://www.eere.energy.gov/biopower/policy/po_ftc.htm#ftc1).
[131] Oregon Department of Energy, *Biomass Energy Incentives* (http://www.energy.state.or.us/biomass/Incentive.htm).
[132] Oregon Department of Energy, *Biomass Energy Incentives* (http://www.energy.state.or.us/biomass/Incentive.htm).

reasons, it is useful to provide some background on the regulatory requirements that have so greatly influenced the development of the fuel ethanol industry in the U.S.

The Clean Air Act of 1970 authorized the EPA to promulgate regulations regarding the quality of conventional fuels. In 1990, the Act was amended to include establishing air quality standards related to vehicle emissions. The EPA subsequently established the National Ambient Air Quality Standards (NAAQS) covering carbon monoxide (CO), nitrogen oxides (NO_x), particulate matter, ozone and lead. Urban areas were required to use cleaner burning fuels if they did not meet the clean air standards. Adding oxygen to gasoline improves combustion efficiency, thereby reducing a variety of air emissions. Ethanol contains 35% oxygen. Substituting ethanol for gasoline results in a reduction of CO, volatile organic compounds and NO_x emissions.[133]

The EPA established a winter oxygenated fuels program for CO nonattainment areas and a year-round reformulated gasoline program for ozone nonattainment areas. For the winter oxygenated fuels program, the minimum oxygen requirement was equivalent to a 7.7% ethanol blend. Ozone nonattainment areas were required to use reformulated gasoline to lower volatile organic compounds by 15% in 1995 and 25% in 2000. Reformulated gasoline must contain a minimum equivalent of 5.7% ethanol by volume. This regulation is applicable only in the summer months, whereas air toxins regulations apply year-round. The Phase II Reformulated Gasoline standards specify maximum benzene content, minimum oxygen content and performance standards for volatile organic compounds (VOCs) in the summer and nitrogen oxides and toxic air pollutants year-round. Refiners must make reductions against a 1990 “baseline gasoline.”[134]

Demand for ethanol increased as a direct result of these federal programs. According to a recent study, “The majority of the increase in ethanol demand in the past 10 years has resulted from these programs. Since 1990, the nation’s ethanol production capacity has more than doubled from 850 million gallons/year to 1.779 billion gallons in total production capacity in 1999.”[135] In addition, the recent phase-out of methyl tertiary butyl ether (MTBE) in California as a fuel additive has increased demand for ethanol. This has led to a need for increases in production capacity. For ethanol to fully replace MTBE, the demand for ethanol in California could reach 550 million gallons per year.[136]

Oregon developed an oxygenated fuels program as part of its comprehensive air quality maintenance plan in response to the national Clean Air Act Amendments of 1990. While Oregon has met air quality standards, it continues to implement the program to sustain its air quality.

Federal Tax Credits for Blenders

The Energy Tax Act of 1978 established a tax exemption for gasohol containing 10% ethanol. The amounts of the tax exemption for blends of less than 10% ethanol (7.7% and 5.7%) are prorated. There are two ways a blender can take advantage of this tax credit: a federal excise tax exemption or an income tax credit.[137] These tax credits were recently extended until 2007. Gasoline refiners, marketers and users (not ethanol producers) are eligible for these tax credits.[138]

[133] A. Graf and T. Koehler, *Oregon Cellulose-Ethanol Study* (Oregon Department of Energy, June 2000), pp. 70-71.
[134] Graf and Koehler, 71.
[135] Graf and Koehler, 71.
[136] Graf and Koehler, 5.
[137] IRS, Publication 510 (http://www.irs.gov/publications/p510/ar02.html#d0e2693).
[138] Renewable Fuels Association, *The Federal Ethanol Program* (http://www.ethanolrfa.org/leg_position_fed.shtml).

Federal Excise Tax Exemption for Gasohol

Gasoline is taxed at 18.4 cents per gallon. Ethanol fuel blends sold by refiners or marketers are taxed at a reduced rate, thereby helping ethanol be more cost competitive. The DOE Energy Information Administration (EIA) predicted that an extension of the tax exemption would increase the ethanol production capacity from grain and cellulose biomass to 2.8 billion gallons per year.[139] Current ethanol production capacity is 2.9 billion gallons per year.[140] Table H-1 shows the 2003 excise tax reduction for the production of gasohol.

Table H-1. Federal excise tax rate reduction in 2003[141]

Ethanol blend (% by volume)	**Tax reduction** (cents/gallon)
10	3.734
7.7	2.804
5.7	2.031

Income Tax Credits

Under the Crude Oil Windfall Profits Action of 1980, it became possible to receive an income tax credit instead of the excise tax forgiveness. The blender must have a tax liability to which the credit can be applied. The income tax credit is applicable to the use or sale of straight alcohol as a fuel (ethanol or methanol) and alcohol mixtures.[142]

Table H-2 shows the amount of this income tax credit for straight ethanol and ethanol blends.

Table H-2. Federal income tax rate reduction for ethanol in 2003[143]

Ethanol blend (% by volume)	**Tax reduction** (cents/gallon)
100	52.000
10	5.200
7.7	4.004
5.7	2.964

Small Ethanol Producer Tax Credit

Small ethanol producers, defined as a producer with an annual production capacity of 30 million gallons or less, are allowed a 10 cents/gallon income tax credit for the first 15 million gallons produced annually.[144]

Deductions for Clean-Fuel Vehicles and Refueling Property

In 1992, the Energy Policy Act (EPACT) required government and private fleets (having 20 or more vehicles in metropolitan areas with more than 250,000 people) to include alternative fuel

[139] Graf and Koehler, 9.
[140] Renewable Fuels Association, *U.S. Fuel Ethanol Production Capacity* (http://www.ethanolrfa.org/eth_prod_fac.html).
[141] IRS, *Form 720 – Quarterly Federal Excise Tax Return* (http://www.irs.gov/pub/irs-fill/f720_d.pdf).
[142] IRS, *Alcohol Fuel Credit* (http://www.irs.gov/publications/p378/ch04.html).
[143] IRS, *Form 6478 – Credit for Alcohol Used as Fuel* (http://www.irs.gov/pub/irs-pdf/f6478.pdf).
[144] Renewable Fuels Association, *Modifications are Needed to Make the Small Ethanol Producer Credit Workable for Farmer* (http://www.ethanolrfa.org/leg_position_smallproducer.shtml).

vehicles in their fleets. The requirement ranges from 30% to 90% of fleet vehicles. The requirement may be met by using fuels containing at least 85% alcohol by volume. Other possibilities include: natural gas, propane, hydrogen, liquid fuels from coal and electricity.

Individuals and businesses are eligible for tax deductions of $2,000 for cars and up to $50,000 for certain types of trucks and vans. The deduction will be gradually phased out by 2005. Property used to store or dispense clean fuel is deductible up to $100,000.[145]

Corporate Alcohol Fuel Credit

Businesses that sell or use alcohol fuels or fuel blends may qualify for an income tax credit. Credits range from $0.3926 to $0.60/gallon, depending on the proof and type of alcohol. [146]

3. FEDERAL BIOMASS TECHNICAL AND FINANCIAL ASSISTANCE PROGRAMS

In addition to offering tax and other production incentives for biomass power and biofuels production, the federal government offers a wide variety of technical assistance and financial assistance in the form of grants for feasibility assessment, research and development, technology demonstration and other efforts aimed at commercializing biomass technology. This section reviews some of the key programs that offer these types of support.

USDA/DOE Joint Biomass Research and Development Initiative

The Biomass Research and Development Initiative supports the advancement of biobased products and bioenergy in order to further the goals of strengthening farm income, creating new jobs in rural communities, enhancing energy security and reducing pollution. The vision that DOE and USDA have set forth for biobased products and bioenergy is to increase the share of biomass power to 5%, transportation fuels to 20% and biobased products to 25% of their respective markets by 2030.[147] The Initiative sponsors programs to support research and development, commercialization and public education efforts. Moreover, programs have been developed to provide technical and financial assistance for producers of bioenergy products. See the Biomass Research and Development Initiative (http://www.bioproducts-bioenergy.gov/) for more information about grants and other funding opportunities.

USDA Value-added Agricultural Producer Grants

An additional $27.7 million was available in FY 2003 through USDA's Value-Added Agricultural Producer Grants program to support feasibility assessments, business planning and working capital for new value-added agricultural products.[148] For more information about this program, contact the Oregon representative for USDA for the program, Robert Haase, via phone: (541) 926-4358 x 124 or e-mail: bob.haase@or.usda.gov.

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[145]North Carolina Solar Center, *DSIRE: Incentives by State* at: http://www.ies.ncsu.edu/dsire/library/includes/incentive2.cfm?Incentive_Code=US30F&State=Federal&currentpageid=1 .

[146]North Carolina Solar Center, *DSIRE* at: http://www.ies.ncsu.edu/dsire/library/includes/incentive2.cfm?Incentive_Code=US30F&State=Federal&currentpageid=1

[147]National Biomass Coordination Office, *Feedstock Map Released,* (http://www.bioproducts-bioenergy.gov/news/DisplayRecentArticle.asp?idarticle=115, January 2004).

[148] USDA Rural Business Cooperative Services, *Value-added Producer Grants* (http://www.rurdev.usda.gov/rbs/coops/vadg.htm).

USDA Rural Business-Cooperative Service

There are a handful of programs under the USDA Rural Business-Cooperative Service that broadly support the development of rural businesses. Fiscal year 2003 funding for the Rural Business-Cooperative Service was as follows:

- Business and Industry Guaranteed - $900 million plus $309 million carryover
- Intermediary Re-lending Program - $40 million
- Rural Business Enterprise Grant - $47.99 million
- Rural Economic Development Loan - $15 million
- Rural Economic Development Grant - $4 million
- Rural Business Opportunity Grant - $4 million[149]

Loan guarantees for biomass conversion into bioenergy are available under the Business and Industry Guaranteed Loan Program. The objective is to create employment in rural areas by expanding the lending capacity of commercial lenders. Up to 90% of a loan made by a commercial lender can be guaranteed, and the maximum loan size is $25 million.[150]

The Intermediary Relending Program provides financing to business facilities and community development projects through intermediaries. The intermediaries establish revolving loan funds for this purpose.[151]

The Rural Business Enterprise Grant program provides funds to public bodies, nonprofit organizations and Indian Tribal groups to finance small business enterprises in "urbanizing areas" outside cities with populations of over 50,000. Grant funds are not provided directly to the business.[152]

Rural Economic Development Loans can be provided at 0% interest to electric and telephone utilities. The utility must re-lend the money at 0% interest to a third-party for the purpose of job creation. Priority is given to areas with populations of less than 2,500 people.

Rural Economic Development Grants are available for rural economic development purposes. Grants are provided to electric and telephone utilities and are used to establish revolving funds. The utility must contribute 20% of the funding for each grant administered.[153]

The Rural Business Opportunity Grant program seeks to promote sustainable economic development in rural communities with exceptional needs. Grants cover the costs of economic

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[149] USDA Rural Business Cooperative Services, *Business Programs* (http://www.rurdev.usda.gov/rbs/busp/bprogs.htm).

[150] USDA Rural Business Cooperative Services, *Business & Industry Guaranteed Loans* (http://www.rurdev.usda.gov/rbs/busp/b&I_gar.htm).

[151] USDA Rural Business Cooperative Services, *Intermediary Relending Program* (http://www.rurdev.usda.gov/rbs/busp/irp.htm).

[152] USDA Rural Business Cooperative Services, *Rural Business Enterprise Grants* (http://www.rurdev.usda.gov/rbs/busp/rbeg.htm).

[153] USDA Rural Business Cooperative Services, *Rural Economic Development Grants* (http://www.rurdev.usda.gov/rbs/busp/redg.htm).

planning, technical assistance for rural businesses and training for rural entrepreneurs or economic development officials.[154]

USDA Renewable Energy Systems and Energy Efficiency

USDA's Renewable Energy Systems and Energy Efficiency Improvements programs assist rural small businesses in developing renewable energy systems and making energy efficiency improvements to their operations. Grant funding was available in the amount of $22 million in FY 2003 for projects that derive energy from wind, solar, biomass, geothermal or hydrogen.[155] For more information about eligible grant recipients, projects and funding guidelines, visit the program website: http://www.nrel.gov/usda/.

USDA Agricultural Research Service Bioenergy & Energy Alternatives Program

The USDA manages several programs designed to increase the use of agricultural crops as feedstocks for biofuels. The Bioenergy and Energy Alternatives Program (under the Agricultural Research Service) conducts research in ethanol, biodiesel, energy alternatives for rural practices and energy crops. Emphasis is on developing or modifying technologies, developing energy crops and improving process economics.[156]

USDA CSREES Agricultural Materials Program

The USDA Cooperative State Research, Education and Extension Service (CSREES) advances research and development in new uses for industrial crops and products through its Agricultural Materials program, National Research Initiative, Small Business Innovation Research Program and other activities. Areas of interest include paints and coatings from new crops, fuels and lubricants, new fibers and biobased polymers from vegetable oils, proteins and starches.[157]

DOE Regional Biomass Energy Program

The Department of Energy sponsored the Regional Biomass Energy Program (RBEP) since 1983. This program sought to increase the production and use of bioenergy resources through technical and financial assistance.[158] In the past, the RBEP has maintained a network of regional offices throughout the United States, and Oregon was part of the Pacific Regional Bioenergy Program (http://www.pacificbiomass.org). Many of the past projects and information are still available on-line. However, the program functions have been assigned to a regional biomass partnership funded for FY 2004. In the future, many of the technical transfer and outreach functions will be performed by DOE regional offices.[159] Key program contact information for the new partnership is on-line at: http://www.ott.doe.gov/rbep/organization.html.

[154] USDA Rural Business Cooperative Services, *Rural Business Opportunity Grants* (http://www.rurdev.usda.gov/rbs/busp/rbog.htm).

[155] USDA, *USDA Farm Bill Section 9006: What is the USDA Farm Bill Section 9006?* (http://www.nrel.gov/usda/what_is.html).

[156] USDA, Biobased Products and Bioenergy Coordinating Council (BBCC), *BBCC Member Agencies* (http://www.ars.usda.gov/bbcc/USDA_BBCC.htm).

[157] USDA CSREES (http://www.reeusda.gov/).

[158] U.S. DOE Office of Transportation Technologies, *What is the Regional Biomass Energy Program* (http://www.ott.doe.gov/rbep/what.html).

[159] U.S. DOE Biofuels Program, *Who We Are* (http://www.ott.doe.gov/biofuels/who_we_are.html).

USFS Small Diameter Utilization Program

The Forest Service, private forestry groups, non-profit orgaizations, states and universities are cooperating under the Small Diameter Utilization Program (http://www.fs.fed.us/fmsc/sdu/index.php). The objective is to provide information in areas such as technology transfer, logging systems, forest products and manufacturing, biomass and marketing.[160]

USFS Economic Action Program

The USFS Economic Action Program provides a range of assistance to rural communities. Program areas included: fuel reduction and utilization projects, bioenergy feasibility studies, wood product utilization and market feasibility studies, support to modify or develop long-range fuels hazard reduction and community economic development planning that expands and diversifies the use of forest products. More information about the Economic Action Program is available on-line at: http://www.fs.fed.us/r6/coop/programs/rca/economic.htm. As an alternative to the Internet, you can contact Charlie Krebs, Program Director via phone: (503) 808-2340 or e-mail: ckrebs@fs.fed.us.

Healthy Forests Restoration Act of 2003 (signed into law on December 3, 2003)

At the time of this writing, the Healthy Forests Restoration Act (HFRA) had recently been signed into law. The interested reader is referred to the following website for a summary of the House and Senate conference report on the HFRA. This website was available as of December 3, 2003. http://capwiz.com/wwipo/webreturn/?url=http://thomas.loc.gov/cgi-bin/bdquery/z?d108:h.r.1904:

The House and Senate conference report findings suggest that funding resulting from the HFRA will provide incentives for the development of outlet markets for biomass, including energy. Title II, Section 2 of the House bill authorizes appropriations of $25,000,000 for FY 2004 through 2008 for grants to improve the commercial value of forest biomass and monitoring for program participants. Sections 203 and 204 of the Senate bill contain comparable funding authorizations. The Senate bill authorizes an additional $5,000,000 for FY 2004 through 2008 for programs that facilitate small business use of biomass.

4. OREGON STATE AND LOCAL INCENTIVES

Pollution Disclosure Requirement

Since March 1, 2002, major electricity suppliers have been required to disclose their fuel mix and emissions using a format prescribed by the Oregon Public Utility Commission. Power source and environmental impact information must be provided to all residential consumers at least quarterly. Renewable resources are reported as "other fuels" unless they comprise over 1.5% of the total fuel mix. Environmental impact information is reported in lbs/kWh. Pollutants that must be disclosed include carbon dioxide, sulfur dioxide and nitrogen oxides.[161] This requirement does not apply to publicly-owned utilities in Oregon.[162]

[160] National Fire Plan (http://www.fireplan.gov/reports/perf_rpt_2002/9-16.pdf, accessed September, 2003).
[161] North Carolina Solar Center, *DSIRE* at:
http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=OR11R&state=OR&CurrentPageID=1
[162] Oregon Secretary of State, State Archives, *Oregon Administrative Rules Division 38: Direct Access Regulation, Section 0300*, OAR 860-038-0300 Electric Company and Electricity Service Suppliers Labeling Requirements (http://arcweb.sos.state.or.us/rules/OARS_800/OAR_860/860_038.html).

Portland Green Power Purchasing

The City of Portland aims to produce or purchase all of its power through renewables. Among other projects, the City is installing four 30-kW bio-gas microturbines at the Columbia Boulevard wastewater treatment plant. The City is also purchasing more than 600,000 kWh/year of renewable resources from the grid. The Office of Sustainable Development is promoting green power purchases to other City bureaus, local businesses and other institutions.[163]

Business Energy Tax Credit Program

Current law provides a 35% tax credit for renewable energy investments. The credit is taken over five years. Unused credit can be carried forward up to eight years. The tax credit can also be transferred to a partner in exchange for cash payment. This allows tax exempt entities to benefit from undertaking projects.[164]

Recent legislation removed the $40 million limit on the annual amount of total projects qualified for the credit program and replaced it with a maximum of $10 million qualified cost per project each year. More than 6,500 credits have been awarded in the areas of energy conservation, recycling, renewable energy resources and less-polluting transportation fuels.[165]

Residential Energy Tax Credit

Homeowners and renters are eligible for a tax credit if they purchase alternative fuel vehicles and charging or fueling systems. The tax credit is 25% of the cost of the vehicle and/or device, not to exceed $750. The tax credit may be claimed for a vehicle and a charging or fueling system for a total of $1,500.[166]

Property Tax Exemptions

Oregon offers incentives for new businesses and property tax exemptions. The Oregon Enterprise Zone Program offers incentives for businesses to create new jobs by encouraging business investment in economically lagging areas of the state. Locating a facility in this zone would allow new construction and most of the equipment installed a 100% property tax abatement for a minimum of three years. Thirty-seven areas in Oregon have been designated as enterprise zones.

The Enhanced Enterprise Zone Program was developed to spur major industrial investments in rural areas of the state with high rates of unemployment. The incentive provides 15 consecutive years of full relief from assessment of all local property taxes at the investment site. Credit equal to gross payroll is applied against state corporate income tax liabilities.

New commercial facilities are exempt from property taxes while they are under construction and may continue the exempt status for two years if they are manufacturing projects.

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[163]North Carolina Solar Center (http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=OR17R&state=OR&CurrentPageID=1).
[164]Oregon Department of Energy, *Oregon Business Energy Tax Credit* (http://www.energy.state.or.us/bus/tax/taxcdt.htm).
[165]Ibid.
[166]Oregon Department of Energy, *Oregon Residential Energy Tax Credit Program* (http://www.energy.state.or.us/res/tax/taxcdt.htm).

Environmental Tax Credits

Oregon provides tax credits to companies that meet or exceed the EPA and Oregon Department of Environmental Quality clean air requirements. A facility may take 50% of the qualified cost of an installation designed to meet state or federal regulations as a tax deduction, subject to a variety of requirements.[167]

Energy Facility Siting Process

Small ethanol production and other biomass facilities producing a fuel product capable of being burned to produce the equivalent of less than six billion Btu/day are not subject to the siting process of the state Energy Facility Siting Council. This would equate to a cellulose ethanol facility of about 28 million gallons per year. In addition, there is an exemption in industrial zones for certain ethanol facilities that produce fuel from gain, potatoes or whey. To qualify for the exemption, the facility must meet certain criteria, but there is no capacity limitation.

Small Scale Energy Loan Program

Renewable energy projects are eligible to receive low interest loans from the Small Scale Energy Loan Program. Businesses, individuals, counties, public agencies, tribes and non-profit organizations may be eligible. Existing renewable energy facilities may qualify for financing for an energy improvement or energy project expansion.[168]

Funding is provided by the sale of bonds is on a periodic basis and, occasionally, to accommodate a particularly large loan request. Although there is no maximum loan size, the largest single loan has been $16.8 million.

General Business Financing

Revolving loans and bonds are available through the Oregon Economic and Community Development Department. The purpose of these loans is to facilitate the creation of employment. Other programs are in place to increase the availability of loans from banks.[169]

Project Development Assistance

The Special Public Works Fund provides Oregon Lottery money for public infrastructure supporting business development projects that create or retain jobs. Eligible applicants include water and sewer districts, cities and counties. If a site under serious consideration needs additional infrastructure, this fund can provide the resources for such improvements.[170]

5. NON-PROFIT ORGANIZATIONS

Non-profit organizations can provide a great deal of in-kind support in getting renewable energy programs up and running through consumer outreach and education and market analysis. The following organizations are supportive of development of renewable energy resources.

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[167] Oregon Department of Environmental Quality, *Pollution Control Facilities Tax Credit Program* (http://www.deq.state.or.us/msd/taxcredits/txcp.htm).

[168] North Carolina Solar Center, *DSIRE* at: http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=OR04F&state=OR&CurrentPageID=1).

[169] Oregon Economic & Community Development Department, *Financing Services* (http://www.econ.state.or.us/financeb.htm).

[170] Oregon Economic & Community Development Department , *Special Public Works Fund* (http://www.econ.state.or.us/spwf.htm).

The Bonneville Environmental Foundation (BEF)

The Bonneville Environmental Foundation (BEF) funds renewable energy projects located in the Pacific Northwest. Project areas include: solar photovoltaics, solar thermal electric, solar hot water, wind, hydro, biomass and animal waste-to-energy.[171]

Funding is provided in the form of grants, loans, convertible loans, guarantees and direct investments in renewable energy projects. BEF renewable energy grants and investments may range from a few thousand dollars for small installations to significant investments in central station grid-connected renewable energy projects. If a BEF grant is requested for a generating project, the BEF share will not exceed 33% of total capital costs and 0% of operating costs.[172]

The Energy Trust

The Energy Trust of Oregon (Energy Trust) was created in March 2002 to invest public purpose funding for energy efficiency and renewable energy in Oregon. Its goals include displacing 300 MW through energy efficiency improvements and helping Oregon meet 10% of its energy needs through renewable energy resources by 2012.[173] In 2003, the Energy Trust budgeted $925,000, or approximately 10% of its Renewable Program budget, for its Open Solicitation, which supports unsolicited renewable energy projects in the areas of small wind, solar photovoltaics, biomass and geothermal. The Energy Trust is funded through a public purposes charge to customers of the two investor-owned electric utilities in Oregon (Portland General Electric and Pacific Power) and NW Natural, a natural gas company.[174]

Renewable Northwest Project

Renewable Northwest Project (http://www.rnp.org/) is a coalition of public interest groups and energy companies that is promoting the development of wind energy and other renewable energy resources. Renewable Northwest works with local organizations and energy companies to put projects on the ground, encourages utilities and customers to invest in renewable energy technologies and promotes renewable energy market development.

NW Energy Coalition

The NW Energy Coalition (http://www.nwenergy.org/) is an alliance of environmental groups, civic organizations, businesses and utilities in Alaska, Idaho, Montana, Oregon, Washington, Montana and British Columbia. The Coalition promotes energy conservation and renewable energy use, consumer protection and fish and wildlife protection on the Columbia and Snake Rivers.

171 BEF, *About BEF* (http://www.b-e-f.org/about/index.shtm).
172 BEF, *BEF Renewable Energy Project Criteria and Proposal Process* (http://www.b-e-f.org/grants/docs/renewable_grant_guide.pdf).
173 Energy Trust of Oregon, *About Energy Trust: Who We Are* (http://www.energytrust.org).
174 Energy Trust of Oregon, *Renewable Programs – Open Solicitation* (http://www.energytrust.org).

APPENDIX I. OVERVIEW OF GASIFICATION TECHNOLOGY

UPDRAFT GASIFIER

The simplest gasifier is the updraft, fixed-bed gasifier. This gasifier pulls hot air from the bottom of the container up through the fuel material, drying it in the process. As the fuel sinks, pyrolysis occurs, producing liquid methanol, acetic acid, tars and solid charcoal. Then the liquids and tars enter a reduction zone, in which a reduction reaction takes place, producing carbon monoxide and hydrogen. These combustible gases can be used for heating or power generation. Lastly, in a high-temperature oxidation zone, hydrocarbons are oxidized to generate energy to run the reduction and pyrolysis reactions. The gas produced is normally a low-Btu gas (150 Btu/cubic foot) that contains residual tars and moisture. Figure I-1 shows a schematic of an updraft gasifier.

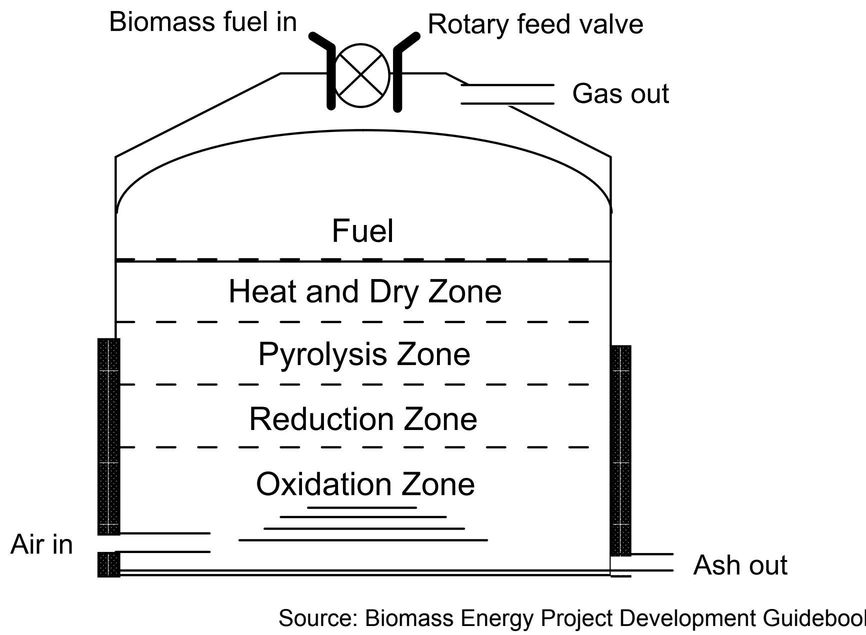


Figure I-1. Updraft gasifier

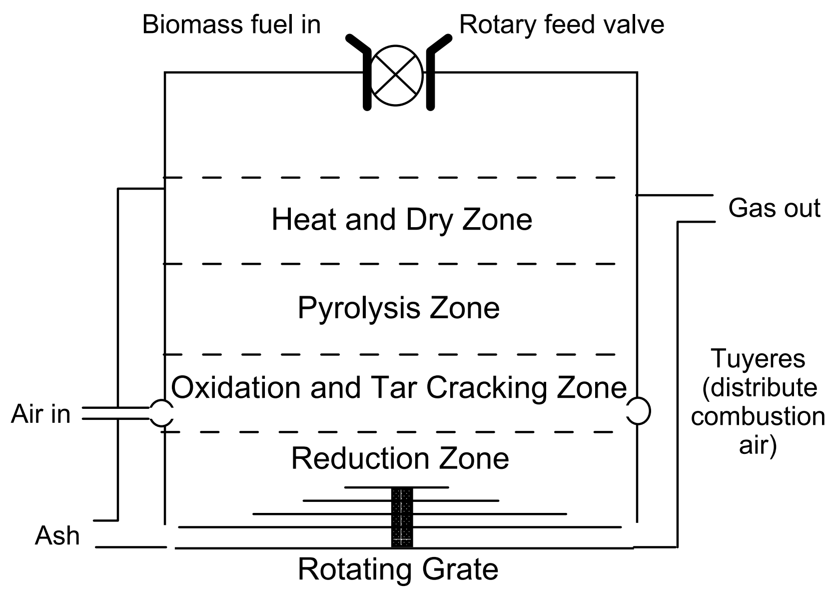
There are a few advantages with this gasifier design. First, the gasifier can be made in a variety of sizes. These sizes can range from small "household" units to large 8,000 lb/hour units. The large units are constrained by the possibility of unmixed areas occurring in the reacting mass. A second advantage is that the low-carbon ash produced does not present a disposal problem.

A disadvantage of updraft gasifiers is that the gas produced cannot be transported through a pipeline because the tars and non-reacted solids will condense. Several proprietary modifications and additions have been made to updraft gasifiers in order to clean the gases so they can be used as engine fuel or transported by pipeline. This "cleanup" results in tar residues that pose a disposal problem.

Also, updraft gasifiers do not give simultaneous control over fuel and air. The lack of simultaneous control over fuel and air results in the development of a combustion zone within a portion of the gasifier. Pyrolysis is not a combustion process, and development of a combustion zone in the gasifier reduces the energy output from the gasifier and can cause slagging with certain feedstocks. This means that updraft gasifiers have a difficult time handling certain slagging-type fuels such as agricultural residues.

DOWNDRAFT GASIFIERS

Although the downdraft gasifier differs only slightly from the updraft gasifier, the differences are important. As in updraft gasification, fuel materials are added to the top of the container. The material is heated to evaporate water, and the pyrolysis process occurs. However, with downdraft gasification, the high temperature oxidation process occurs after the pyrolysis rather than after the reduction stage. This allows the tars and oils from the gasification process to be filtered with the char in the reduction stage. As a result, the low-Btu gas that is produced is very clean and can be used for boilers, furnace fuel or for internal combustion engines. Figure I-2 shows a schematic of a downdraft gasifier.



Source: Biomass Energy Project Development Guidebook

Figure I-2. Downdraft gasifier

The advantages of sizing and low ash content mentioned for the updraft gasifier are also available with the downdraft gasifier. However, the downdraft gasifier has the additional advantage of producing clean gas that can be transported by pipeline. Disadvantages of downdraft gasifiers include the fact that they are very sensitive to moisture and cannot handle fuels that contain more than 30% water. Also, downdraft gasifiers have a hot zone and do not give simultaneous control of fuel and air. The lack of simultaneous control over fuel and air results in the development of a combustion zone within a portion of the gasifier. The combustion zone is an unwanted characteristic of this type of gasifier that reduces the gas output of the system and can result in slagging on the inside of the gasifier with certain types of biomass feedstock. This means that downdraft gasifiers cannot be used with certain slagging-type fuels such as most agricultural residue.[175]

[175] This was demonstrated by John Goss at the University of California, Davis, and quoted in Dr. Wayne LePori's (Texas A&M University) May 22, 1993, letter to NEOS Corporation.

FLUIDIZED BED GASIFIERS

Figure I-3 shows a schematic of a fluidized bed gasifier. In this type of gasifier, the bed is continually mixed. The mixing results in relatively uniform temperatures and fuel composition throughout the fluidized zone. The gas produced by an atmospheric-type fluidized bed gasifier generally is a low-Btu gas of approximately 150 to 200 Btu/cubic foot at standard conditions. However, pressurized beds or use of oxygen rather than air can increase this to roughly 500 Btu/cubic foot.

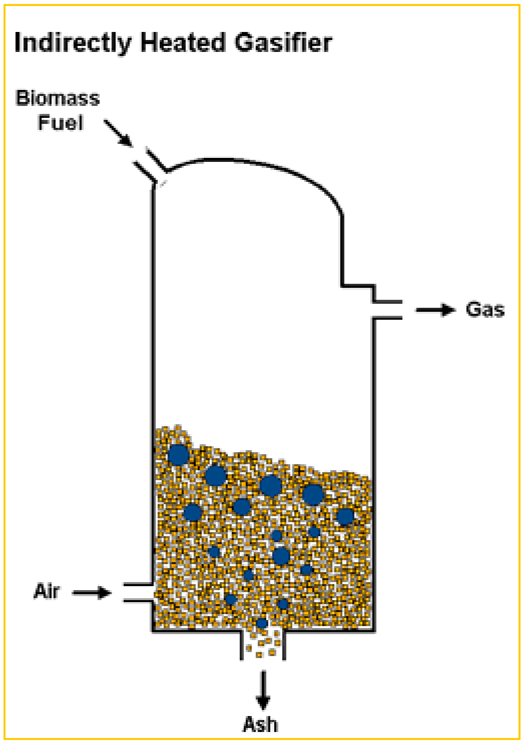


Figure I-3. Fluidized bed gasifier

There are some major differences between the fluidized bed gasifiers and the updraft or downdraft gasifiers described previously. Because pyrolysis occurs very rapidly, fuel residence time is short. This means that the fluidized bed gasifier offers the potential to produce a larger quantity of gas than other types of gasifiers.[176] The gas produced by fluidized bed gasifiers is relatively clean and can be used in an engine, a gas turbine or as boiler fuel, although gas cleanup is still required. Fluidized beds are less sensitive to particle size than other thermal systems. They will accept almost any size particle that can be fed into the unit. In addition, fluidized bed gasifiers can utilize feedstocks that contain more contaminants (such as salt, dirt and high ash content feedstocks) than can normally be gasified in other systems. Fluidized bed gasifiers develop an isothermal zone that is low temperature and deficient in oxygen. An isothermal zone is an area of consistent temperature within the gasifier. This low-temperature, oxygen-starved zone creates a reducing atmosphere, and full combustion (and hence slagging) does not occur.

[176] J. Vranizan et al., *Biomass Energy Project Development Guidebook*, Chapter 4 - Conversion Technologies.

HOT GAS CLEANUP

When many biomass fuels are converted to gas, ash is entrained in to the gas stream. Before the gas is used, the ash must be removed to prevent slagging. Preferably, the removal should take place at the temperature of the hot gas (1,200 degrees F to 1,400 degrees F) so that heat is not lost during the process. The temperature at which the solids separation takes place can be lower, but it should be higher than 800 degrees F to prevent tar condensation. Removing ash prior to combustion requires smaller solids separation equipment than would be necessary if the solids were removed after it is burned in a gas engine, gas boiler or other energy conversion device, because the volume of gas is much greater following combustion. A smaller solids separation device is a significant advantage of gasification over direct combustion, because it can significantly reduce the costs of particulate matter emissions control.

SUMMARY OF GASIFICATION

To prevent ash slagging, most high-ash, high-alkali fuels must be converted into a gas in a reduced (oxygen-starved) atmosphere at a temperature less than 1,450 degrees F during the entire process. It is important to maintain this reducing atmosphere. If the reaction is allowed to shift to combustion within the gasifier, slagging will most likely occur. The fluidized bed gasifier is the only gasifier that presently meets these requirements.