RESOURCE ASSESSMENT OF WASTE FEEDSTOCKS FOR ENERGY USE IN THE WESTERN REGIONAL BIOMASS ENERGY AREA

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I. Executive Summary

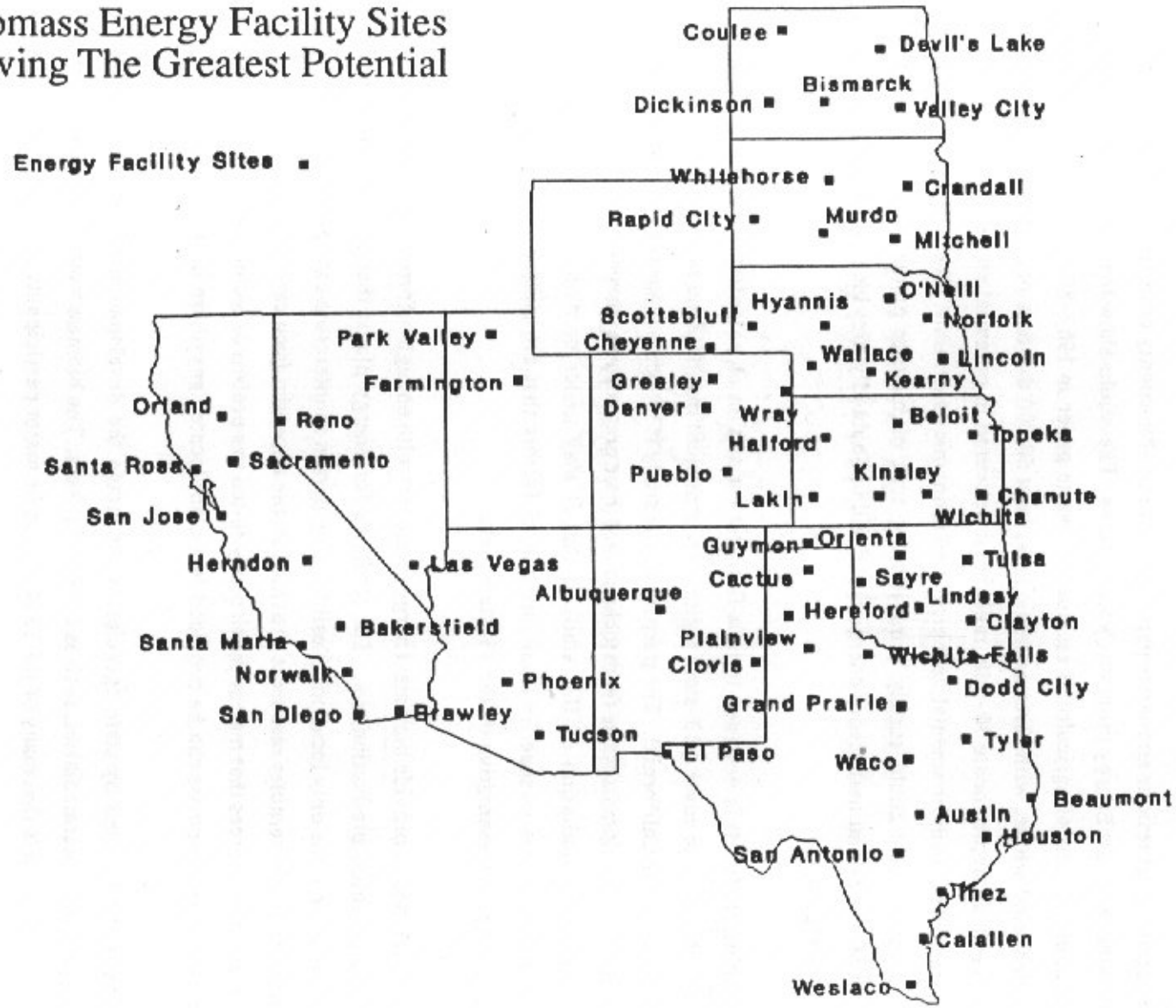
The purpose of this study is to evaluate the near term potential of waste feedstock supplies, specifically agricultural residue and waste paper, on a county-by-county basis for the 13 states in the Western Regional Biomass Energy Program (WRBEP) area. The results show that the region produced over 175 million dry tons of agricultural residue and waste paper in 1987-88. Sixty-nine locations have been identified where, with three exceptions, at least 50,000 dry tons per year of biomass can be collected from an approximate 70-mile radius and delivered to potential energy producers after allowances are made for environmental, technical, and economic constraints. There were a significant number of locations that could supply 1 million dry tons of biomass annually. Moreover, the development of woody and herbaceous energy crops will undoubtedly provide new energy resources for the WAPA region.

This is a scoping study. It is designed to be a first-cut estimation of **potential** waste resources and prices. It was designed to cover a 13-state region in a consistent manner (the same assumptions used for Kansas are used for California). The purpose of the study is to locate areas that have sufficiently large concentrations of biomass waste feedstocks so that these areas can be isolated for future, detailed analysis. The major limitation of this study is that it may under or over-estimate supplies of resources and their prices in specific locals because of factors that are unique to particular areas; factors that are not representative of the 13-state area.

This study is intended to provide biomass-energy producers with enough information to narrow down a search for a potential production site. The locations for energy plants that are indicated on the following page are not the only locations possible. Any person so interested can take the county-by-county estimates of deliverables resources provided in the appendix (you can even selectively chose individual types of resources that may be particularly suited to a process or technology) and determine how much deliverable biomass can be provided to a plant located anywhere in the WRBEP area.

This document can be used by state agencies to encourage the development of renewable energy producers, users, and intermediaries, such as biomass brokers. The biomass waste feedstock potential of the WAPA area ensures that many of the 13 states can be major participants in the biomass-energy industry.

Biomass Energy Facility Sites Having The Greatest Potential



II. Introduction

The production of energy from biomass has received considerable attention in recent years as new technologies develop (like pellet plants), environmental restrictions on burning crop residues or landfilling wastes increase, and our understanding of issues related to global warming improve. Today, there is a heightened interest in biomass waste resources as a energy fuels. This stems from the fact that half of all Americans live in areas that fail to meet Federal clean air standards, landfill capacity is declining rapidly, and local communities can benefit from waste-to-energy facilities. In addition, combustion of conventional fossil fuels contributes to the CO_2 released to the atmosphere in U.S. each year and it is believed by many that the accumulation of CO_2 will lead to the warming of the earth and severe climatic, environmental and socio-economic consequences.

There are large amounts of waste resources that can be used to augment our energy supplies and reduce reliance on unstable sources of fossil fuels. However, it is very difficult for potential energy producers to determine where these waste supplies exist, what they are, how much they might cost, and how much could be delivered to a plant gate. Without location specific information, the development of a waste-to-energy industry is delayed.

The purpose of this report is to evaluate the near term potential of currently available biomass waste feedstocks in the 13-state WRBEP region, which includes Arizona, California, Colorado, Kansas, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, Utah, and Wyoming. Information is provided on supplies and costs of paper from municipal solid waste and agricultural residues for each state and its counties. Also, locations are pinpointed where, with three exceptions, at least 50,000 annual dry tons of lignocellulosic biomass can be collected from an approximate 70-mile radius and delivered to a potential energy facility.

A second study was performed (N. Hinman, SERI, March 1990), using the feedstock information developed in this report, as an example of how this information could be used by energy producers. Each of the plants identified in this report were modeled as ethanol plants using the future biomass-to-ethanol technology being developed at SERI in order to determine which would be the least-cost producer in the WRBEP region. A similar process could be used for fiber fuel and other energy producers interested in locating in the WRBEP area.

III. Resource Assessment

There are four major sources of biomass for energy production in the 13-state WRBEP region: (1) municipal solid waste; (2) agricultural crop residues; (3) wood wastes generated during forestry or milling operations; and (4) wastes from livestock, food processing and wood processing operations. Each source has unique characteristics and different opportunities as a potential feedstock.

This report provides information on supplies and costs of paper from municipal solid waste (MSW) and agricultural crop residues in the WRBEP region. Nonpaper biomass components of MSW were not included in this study because on a dry ton basis they represent a relatively small amount of material. For example yard wastes are more than 80 percent water content as delivered. If the 12.5 million tons of yard waste produced in 1986 is adjusted to remove the water to determine the amount of material available for ethanol conversion, only 2.5 million tons of oven-dried biomass is available nationwide.

Consistent and uniform information on logging and milling activities by county was not available for the 13 states in the WRBEP region. The Forest Area Management Plans were reviewed for the National Forests in the WRBEP area; and State Forest agencies and state university forestry departments were contacted for information concerning harvesting volumes, location of harvesting activities, and mill operations. Some states had extensive information bases. Some states had none. Most of the information bases were aggregated on the State level. A few states had forestry and mill operations disaggregated on a county level. County-level information is required in order to accurately access where the material is located or where energy plants would have to be located to use such material. While there are substantial opportunities to produce waste wood feedstocks in all 13 states, these opportunities were not accounted for in this report as it would be inherently unfair to characterize the wood waste opportunities in some states and not in others and thereby implying that some states did not have any significant supplies of wood waste when the opposite was true. Addition of these materials would significantly expand the quantities of biomass available in some areas, and may be an area of future research by WRBEP member states.

Finally, livestock wastes such as manure produced at dairies and feedlots, wastes from grain and cotton cleaning operations, canning wastes such as peach pits and potato slurry, and wood wastes from mills, pallet manufacturers, and furniture industries were not included in this assessment. These resources were excluded for the same reasons that wood wastes were excluded: fragmented data bases,

no data disaggregation on the county level, and inconsistent reporting procedures from state to state.

However, there are undoubtedly opportunities in the WRBEP region for using these materials to produce energy products. Unfortunately, because there is no centralized source of waste stream information in many states, it may be difficult to pinpoint these opportunities. The state's Departments of Health and Environmental Protection Agencies do not consistently record information concerning the composition of waste streams unless they pose a direct and known hazard to human health. Local and state level resource assessments could improve the level of information in this area.

IV. Methodology

There are four levels of biomass resource assessment: the total resource, the collectable resource, the deliverable resource, and feedstock supply. The total resource is the amount of biomass available in a given area without regard to regulations, technical, physical or economic collection limitations. The total amount of crop residue left in a field after the grain is harvested is an example of the total resource. The collectable resource is the amount of biomass that can be collected after allowing for regulatory and technical limitations, such as: erosion control, tillage practice, and machine efficiency for collecting the residue. The deliverable biomass resource is the amount of the collectable resource that can be obtained after allowing for such limitations as: bad weather inhibiting machine operation, equipment availability for collection, other economic uses for the biomass, and non-participation for other reasons. The feedstock supply is the deliverable biomass resource that can be collected within a specific collection radius. A small quantity of feedstock supply may not be sufficient to support even a small energy plant.

The first three levels of resource estimations (total, collectible, and deliverable) are estimated for wastepaper and agricultural residues supplies in every county of the WRBEP region. From estimates of deliverable biomass, locations were pinpointed where at least 50,000 tons of feedstock supply as waste paper and/or agricultural residue could be collected within an approximate 70 mile radius. (There were three exceptions to this guideline.) The reason for specifying a 70 mile radius is explained in Section B.2., "Cost of Agricultural Residues Except Orchard Trimmings."

A. Waste Paper from MSW

The methodology used to estimate the first three levels of waste paper supplies from MSW for each county and the costs associated with collecting and delivering waste paper to a potential ethanol plant are described below.

A.1. Levels of Resource Supply

MSW is composed of metal, plastics, glass, yard wastes, kitchen wastes, paper products, and other miscellaneous items. Table III-1. provides estimates by Franklin Associates, Ltd. (1988) on historical and projected composition of MSW for the entire United States. From this it can be seen that paper products and paperboard wastes are the largest and most consistent component of MSW for ethanol

Nebraska

Nebraska is the largest producer of biomass resources in the WRBEP region, producing more than 45 million dry tons annually. Thirteen counties each produce more than 1 million tons of biomass per year. More than 99 percent of the total biomass resource consists of agricultural residue. Corn residue represent 84 percent of total biomass resources. Despite the fact the more than 36 percent of all the cropland in Nebraska is under some form of conservation tillage, 8.7 million tons per year, almost 20 percent of the total biomass, is deliverable. This reflects the high level of irrigation and high corn yields characteristic of Nebraska.

Seven plant locations have been identified in Nebraska, three of which receive more than 1 million tons of feedstocks annually, and two of those receive more than 2 million tons per year. Not surprisingly, corn residue is the dominate feedstock. The potential feedstock supply to each plant is as follows:

Plant Location	Feedstock (tons/yr)
Lincoln - Lancaster County	2,609,726
Norfolk - Madison County	1,707,847
Scott's Bluff - Scott's Bluff County	410,568
Wallace - Lincoln County	850,185
Hyannis - Grant County	111,420
Kearny - Buffalo County	2,711,513
O'Neill - Holt County	254,723

If all seven plants are constructed, Nebraska residents would receive an estimated $335 million in revenues for sales of biomass. A significant amount of this revenue would be injected into predominately rural areas.

The rich agricultural land found in Nebraska is also ideally suited to production of dedicated energy crops, such as corn, sorghum, and hay. High yielding grass-like crops similar to hay can be grown in areas with highly erodible soil, which could reduce the need to enroll large acreage of productive cropland in the Environmental Conservation Acreage Reserve Program. Grass-like crops do not require row-seedings and their roots systems reduce the level of erosion compared to row crops. Perennial crops and drill seeding can further reduce erosion risks. Revenues from dedicated energy crops can also improve income stability.

Additional details are provided for Nebraska in the tables in the Appendices A and B.

TABLE NE1. TOTAL BIOMASS RESOURCES FOR NEBRASKA, BY COUNTY AND TYPE

COUNTY/CROP	TOTAL IN-FIELD RESIDUE RESOURCE (DRY TONS)								TOTAL IN-FIELD AGRICULTURAL RESIDUE	PAPER	TOTAL BIOMASS RESOURCE
	WHEAT	CORN	SORGHUM	BARLEY	OATS	RYE	COTTON	ORCHARDS			
Adams	54,515	961,308	52,620	0	1,142	0	0	0	1,069,586	7,223	1,076,809
Antelope	1,241	957,940	370	259	4,704	604	0	0	965,117	1,996	967,113
Arthur	351	30,337	0	0	0	0	0	0	30,688	119	30,807
Banner	84,510	21,578	504	4,590	1,646	2,489	0	0	115,317	238	115,555
Blaine	296	22,593	0	0	0	0	0	0	22,889	166	23,055
Boone	3,281	790,519	3,293	130	6,586	302	0	0	804,109	1,663	805,772
Box Butte	136,380	264,046	0	6,797	4,928	2,879	0	0	415,031	3,327	418,358
Boyd	3,463	66,462	13,661	1,152	5,475	4,032	0	0	94,245	737	94,981
Brown	300	246,721	179	72	224	252	0	0	247,748	927	248,675
Buffalo	19,934	1,227,983	15,064	112	887	261	0	0	1,264,242	8,792	1,273,034
Burt	3,111	413,670	554	130	2,218	302	0	0	419,984	1,972	421,956
Butler	18,630	641,953	112,081	133	3,333	263	0	0	776,394	2,162	778,556
Cass	40,953	281,998	65,772	133	2,094	263	0	0	391,213	5,251	396,464
Cedar	775	420,241	370	2,203	25,088	5,132	0	0	453,809	2,542	456,351
Chase	97,079	861,823	4,186	1,123	1,626	1,042	0	0	966,879	1,093	967,972
Cherry	2,574	52,721	938	72	403	252	0	0	56,960	1,544	58,504
Cheyenne	368,495	88,471	580	4,860	5,544	2,196	0	0	470,146	2,376	472,522
Clay	26,877	902,884	71,271	0	482	0	0	0	1,001,514	1,806	1,003,320
Colfax	4,355	372,308	3,130	133	5,591	263	0	0	385,781	2,186	387,967
Cuming	469	463,984	739	130	4,334	302	0	0	469,958	2,614	472,572
Custer	46,217	1,155,421	3,856	112	1,756	261	0	0	1,207,622	3,041	1,210,664
Dakota	316	147,840	0	130	4,973	302	0	0	153,561	4,087	157,648
Dawes	52,980	14,259	126	2,970	4,583	1,220	0	0	76,138	2,186	78,324
Dawson	7,449	1,320,360	2,307	0	1,008	0	0	0	1,331,124	4,919	1,336,043
Deuel	145,784	67,357	756	5,573	9,569	2,099	0	0	231,137	547	231,684
Dixon	316	193,950	185	130	10,214	302	0	0	205,097	1,568	206,665
Dodge	3,325	620,074	12,104	0	1,613	0	0	0	637,116	8,412	645,528
Douglas	1,040	174,000	1,008	0	538	0	0	0	176,586	99,656	276,242
Dundy	67,060	483,756	15,394	130	1,599	130	0	0	568,070	642	568,711
Fillmore	40,586	989,262	105,574	0	936	0	0	0	1,136,358	1,758	1,138,116
Franklin	44,413	439,213	50,551	0	1,192	0	0	0	535,369	950	536,319
Frontier	82,846	396,742	42,907	302	2,744	260	0	0	525,802	808	526,610
Furnas	123,404	283,190	62,213	313	1,568	210	0	0	470,898	1,402	472,300
Gage	103,362	196,943	287,280	130	4,140	60	0	0	591,914	5,513	597,427
Garden	93,277	91,296	504	2,592	4,516	976	0	0	193,161	642	193,803
Garfield	592	67,891	179	0	296	0	0	0	68,958	499	69,457
Gosper	26,543	418,009	27,989	0	860	0	0	0	473,400	499	473,899
Grant	0	2,340	0	72	0	252	0	0	2,664	190	2,854
Greeley	2,188	396,042	2,573	0	560	0	0	0	401,363	760	402,123
Hall	4,438	1,184,457	7,515	223	152	523	0	0	1,197,308	11,548	1,208,856
Hamilton	4,683	1,492,778	39,802	0	448	0	0	0	1,537,711	2,162	1,539,873
Harlan	72,157	389,318	61,116	104	2,365	70	0	0	525,130	950	526,081
Hayes	82,369	187,436	9,565	518	2,016	521	0	0	282,425	285	282,710
Hitchcock	139,756	174,565	40,118	443	3,660	391	0	0	358,933	927	359,860

TABLE NE1. TOTAL BIOMASS RESOURCES FOR NEBRASKA, BY COUNTY AND TYPE (cont.)

COUNTY/CROP	TOTAL IN-FIELD RESIDUE RESOURCE (DRY TONS) WHEAT	CORN	SORGHUM	BARLEY	OATS	RYE	COTTON	ORCHARDS	TOTAL IN-FIELD AGRICULTURAL RESIDUE	PAPER	TOTAL BIOMASS RESOURCE
Holt	5,527	1,189,227	717	72	4,066	252	0	0	1,199,860	3,113	1,202,973
Hooker	0	580	0	0	0	0	0	0	580	238	818
Howard	5,513	33,368	4,046	112	726	261	0	0	44,026	1,521	45,547
Jefferson	72,007	221,719	139,485	130	2,520	60	0	0	435,921	2,162	438,083
Johnson	23,577	56,148	79,302	0	1,257	0	0	0	160,284	1,141	161,424
Kearney	42,143	1,160,556	29,462	0	202	0	0	0	1,232,362	1,592	1,233,954
Keith	89,285	310,578	2,383	2,203	3,584	2,214	0	0	410,248	2,067	412,315
Keya Paha	1,956	26,150	179	72	560	252	0	0	29,170	261	29,431
Kimball	154,853	16,938	529	9,180	2,330	4,978	0	0	188,807	1,069	189,877
Knox	2,366	336,541	6,913	2,203	22,176	5,132	0	0	375,332	2,519	377,851
Lancaster	110,932	80,427	287,815	0	4,390	0	0	0	483,564	50,279	533,843
Lincoln	59,383	940,543	2,430	238	1,756	260	0	0	1,004,610	8,008	1,012,618
Logan	6,848	92,639	0	72	305	252	0	0	100,115	238	100,353
Loup	597	40,167	0	0	215	0	0	0	40,979	190	41,169
McPherson	457	18,880	0	0	0	0	0	0	19,337	143	19,480
Madison	1,275	559,416	185	130	4,045	302	0	0	565,353	7,675	573,028
Merrick	2,662	928,005	2,209	0	986	0	0	0	933,862	2,020	935,882
Morrill	38,827	276,716	252	346	1,333	146	0	0	317,619	1,354	318,973
Nance	13,163	372,059	15,506	0	2,016	0	0	0	402,744	1,046	403,790
Nemaha	31,941	163,732	29,828	130	1,254	60	0	0	226,945	1,972	228,918
Nuckolls	86,374	244,360	111,759	259	1,906	120	0	0	444,778	1,473	446,251
Otoe	46,818	202,385	110,317	0	1,684	0	0	0	361,205	3,445	364,650
Pawnee	22,420	24,051	79,290	0	1,505	0	0	0	127,266	832	128,098
Perkins	194,141	649,098	2,951	10,836	4,301	9,117	0	0	870,444	855	871,300
Phelps	13,181	1,532,460	15,848	104	323	70	0	0	1,561,985	2,329	1,564,314
Pierce	622	550,915	185	130	6,810	302	0	0	558,963	1,996	560,959
Platte	10,805	906,109	3,713	0	5,461	0	0	0	926,089	7,223	933,312
Polk	6,234	691,942	89,040	0	645	0	0	0	787,861	1,402	789,263
Red Willow	114,248	305,965	57,327	295	1,693	260	0	0	479,790	2,994	482,784
Richardson	30,371	132,269	42,087	130	1,411	60	0	0	206,327	2,424	208,751
Rock	753	177,973	179	0	56	0	0	0	178,961	523	179,484
Saline	82,049	338,646	167,580	130	3,011	60	0	0	591,475	3,065	594,541
Sarpy	1,607	148,156	1,462	133	1,004	263	0	0	152,623	23,334	175,957
Saunders	24,333	572,258	59,629	0	5,443	0	0	0	661,663	4,443	666,106
Scotts Bluff	16,456	453,196	126	594	1,129	244	0	0	471,745	8,816	480,561
Seward	26,591	527,156	161,778	0	2,628	0	0	0	718,153	3,778	721,931
Sheridan	85,451	148,551	378	4,352	4,950	1,903	0	0	245,586	1,735	247,320
Sherman	6,972	333,709	6,070	223	1,021	523	0	0	348,519	927	349,446
Sioux	7,857	71,359	0	302	1,075	146	0	0	80,740	380	81,120
Stanton	949	217,397	554	259	5,510	604	0	0	225,274	1,568	226,842
Thayer	90,821	529,092	114,806	0	986	0	0	0	735,704	1,663	737,367
Thomas	0	4,437	0	0	0	0	0	0	4,437	214	4,650
Thurston	469	172,779	185	130	8,758	302	0	0	182,623	1,687	184,310

TABLE NE1. TOTAL BIOMASS RESOURCES FOR NEBRASKA, BY COUNTY AND TYPE (cont.)

COUNTY/CROP	TOTAL IN-FIELD RESIDUE RESOURCE (DRY TONS)								TOTAL IN-FIELD AGRICULTURAL RESIDUE	PAPER	TOTAL BIOMASS RESOURCE
	WHEAT	CORN	SORGHUM	BARLEY	OATS	RYE	COTTON	ORCHARDS			
Valley	7,976	374,444	2,792	223	813	523	0	0	386,771	1,331	388,102
Washington	2,866	282,873	2,503	0	3,727	0	0	0	291,970	3,802	295,772
Wayne	469	261,808	370	259	12,880	604	0	0	276,389	2,329	278,718
Webster	66,984	198,022	58,934	104	1,631	70	0	0	325,746	1,069	326,815
Wheeler	148	213,225	0	0	314	0	0	0	213,687	238	213,924
York	4,208	1,266,550	21,857	0	376	0	0	0	1,292,991	3,540	1,296,531
STATE TOTAL	3,628,172	38,331,615	2,831,898	69,120	272,384	57,750	0	0	45,190,938	380,707	45,571,645

TABLE NE2. TOTAL DELIVERABLE BIOMASS RESOURCE FOR NEBRASKA, BY COUNTY AND TYPE

COUNTY/CROP	TOTAL DELIVERABLE RESIDUE (DRY TONS)								TOTAL DELIVERABLE AGRICULTURAL RESIDUE	PAPER	TOTAL DELIVERABLE BIOMASS
	WHEAT	CORN	SORGHUM	BARLEY	OATS	RYE	COTTON	ORCHARDS			
Adams	5,116	115,335	4,961	0	0	0	0	0	125,412	5,779	131,191
Antelope	0	195,583	45	0	0	0	0	0	195,628	1,597	197,225
Arthur	60	5,070	0	0	0	0	0	0	5,131	95	5,226
Banner	6,246	4,280	0	0	0	0	0	0	10,526	190	10,716
Blaine	0	4,936	0	0	0	0	0	0	4,936	133	5,069
Boone	401	188,683	439	0	0	0	0	0	189,522	1,331	190,853
Box Butte	8,025	59,403	0	0	0	0	0	0	67,428	2,661	70,089
Boyd	223	13,083	1,940	0	0	0	0	0	15,245	589	15,834
Brown	17	33,160	32	0	0	0	0	0	33,208	741	33,949
Buffalo	1,399	224,933	1,139	0	0	0	0	0	227,471	7,033	234,504
Burt	444	119,439	102	0	0	0	0	0	119,985	1,578	121,563
Butler	3,812	176,396	23,318	0	0	0	0	0	203,526	1,730	205,256
Cass	7,684	64,892	13,330	0	0	0	0	0	85,905	4,201	90,106
Cedar	110	87,937	47	0	0	0	0	0	88,094	2,034	90,128
Chase	5,333	167,032	327	0	0	0	0	0	172,691	874	173,566
Cherry	42	3,406	0	0	0	0	0	0	3,448	1,236	4,684
Cheyenne	43,727	23,147	26	0	0	0	0	0	66,900	1,901	68,801
Clay	4,591	168,427	11,255	0	0	0	0	0	184,273	1,445	185,718
Colfax	822	82,704	610	0	0	0	0	0	84,137	1,749	85,886
Cuming	68	90,987	88	0	0	0	0	0	91,143	2,091	93,234
Custer	5,197	269,006	451	0	0	0	0	0	274,654	2,433	277,088
Dakota	46	31,747	0	0	0	0	0	0	31,794	3,270	35,063
Dawes	6,341	2,663	0	0	0	0	0	0	9,004	1,749	10,753
Dawson	1,131	230,113	354	0	0	0	0	0	231,599	3,935	235,534
Deuel	25,813	21,444	0	0	0	0	0	0	47,257	437	47,694
Dixon	46	26,036	24	0	0	0	0	0	26,107	1,255	27,362
Dodge	650	158,924	2,738	0	0	0	0	0	162,312	6,729	169,041
Douglas	127	38,369	195	0	0	0	0	0	38,690	79,725	118,415
Dundy	5,000	90,938	1,132	0	0	0	0	0	97,070	513	97,584
Fillmore	7,409	253,335	18,686	0	0	0	0	0	279,430	1,407	280,837
Franklin	8,902	73,768	3,352	0	0	0	0	0	86,023	760	86,783
Frontier	14,879	35,975	1,323	41	0	0	0	0	52,218	646	52,864
Furnas	19,439	33,190	1,744	0	0	0	0	0	54,373	1,122	55,494
Gage	19,700	62,020	56,100	0	0	0	0	0	137,820	4,410	142,230
Garden	15,977	15,223	0	0	0	0	0	0	31,199	513	31,713
Garfield	0	16,765	32	0	0	0	0	0	16,797	399	17,196
Gosper	4,419	68,810	936	0	0	0	0	0	74,165	399	74,564
Grant	0	776	0	0	0	0	0	0	776	152	928
Greeley	355	88,069	313	0	0	0	0	0	88,737	608	89,345
Hall	177	183,925	709	0	0	0	0	0	184,810	9,238	194,049
Hamilton	953	283,275	3,346	0	0	0	0	0	287,575	1,730	289,305
Harlan	13,883	78,804	4,830	0	0	0	0	0	97,517	760	98,277

TABLE NE2. TOTAL DELIVERABLE BIOMASS RESOURCE FOR NEBRASKA, BY COUNTY AND TYPE (cont.)

COUNTY/CROP	TOTAL DELIVERABLE RESIDUE (DRY TONS)								TOTAL DELIVERABLE AGRICULTURAL RESIDUE	PAPER	TOTAL DELIVERABLE BIOMASS
	WHEAT	CORN	SORGHUM	BARLEY	OATS	RYE	COTTON	ORCHARDS			
Hayes	9,475	28,485	50	0	0	0	0	0	38,011	228	38,239
Hitchcock	25,057	23,299	4,538	0	0	0	0	0	52,894	741	53,635
Holt	110	143,690	69	0	0	0	0	0	143,869	2,490	146,359
Hooker	0	192	0	0	0	0	0	0	192	190	382
Howard	456	4,475	606	0	0	0	0	0	5,537	1,217	6,754
Jefferson	15,203	56,419	18,770	0	0	0	0	0	90,392	1,730	92,122
Johnson	4,031	17,859	15,441	0	0	0	0	0	37,331	912	38,243
Kearney	7,121	192,374	4,665	0	0	0	0	0	204,160	1,274	205,434
Keith	0	55,981	115	0	0	0	0	0	56,096	1,654	57,750
Keya Paha	167	5,048	32	0	0	0	0	0	5,246	209	5,455
Kimball	1,153	4,103	81	0	0	0	0	0	5,337	855	6,193
Knox	347	73,679	1,285	0	0	0	0	0	75,311	2,015	77,326
Lancaster	20,649	17,726	41,552	0	0	0	0	0	79,926	40,223	120,150
Lincoln	0	175,124	275	0	0	0	0	0	175,399	6,406	181,805
Logan	763	14,642	0	0	0	0	0	0	15,405	190	15,595
Loup	21	9,031	0	0	0	0	0	0	9,052	152	9,204
McPherson	21	1,222	0	0	0	0	0	0	1,243	114	1,357
Madison	190	139,296	34	0	0	0	0	0	139,520	6,140	145,660
Merrick	376	136,270	274	0	0	0	0	0	136,920	1,616	138,535
Morrill	3,652	57,277	0	0	0	0	0	0	60,929	1,084	62,012
Nance	2,222	80,607	2,215	0	0	0	0	0	85,044	836	85,881
Nemaha	5,845	38,417	2,555	0	0	0	0	0	46,817	1,578	48,395
Nuckolls	14,826	37,548	9,897	0	0	0	0	0	62,271	1,179	63,450
Otoe	5,979	34,097	12,603	0	0	0	0	0	52,679	2,756	55,436
Pawnee	3,866	5,915	11,063	0	0	0	0	0	20,844	665	21,509
Perkins	2,016	101,580	12	1,534	0	0	0	0	105,142	684	105,826
Phelps	2,087	269,990	517	0	0	0	0	0	272,594	1,863	274,457
Pierce	0	143,891	28	0	0	0	0	0	143,919	1,597	145,516
Platte	1,294	241,323	708	0	0	0	0	0	243,325	5,779	249,103
Polk	1,356	173,097	8,953	0	0	0	0	0	183,406	1,122	184,528
Red Willow	16,742	22,085	0	0	0	0	0	0	38,827	2,395	41,222
Richardson	5,039	23,722	4,415	0	0	0	0	0	33,176	1,939	35,115
Rock	63	21,143	32	0	0	0	0	0	21,237	418	21,655
Saline	15,670	68,902	29,615	0	0	0	0	0	114,187	2,452	116,639
Sarpy	323	26,725	345	0	0	0	0	0	27,392	18,667	46,059
Saunders	5,369	142,254	11,613	0	0	0	0	0	159,236	3,555	162,791
Scotts Bluff	1,875	150,955	0	0	0	0	0	0	152,830	7,052	159,882
Seward	5,517	156,055	31,297	0	0	0	0	0	192,868	3,022	195,890
Sheridan	12,913	36,665	0	0	0	0	0	0	49,577	1,388	50,965
Sherman	342	46,682	207	0	0	0	0	0	47,231	741	47,972
Sioux	982	20,835	0	0	0	0	0	0	21,818	304	22,122
Stanton	84	40,328	102	0	0	0	0	0	40,513	1,255	41,768

TABLE NE2. TOTAL DELIVERABLE BIOMASS RESOURCE FOR NEBRASKA, BY COUNTY AND TYPE (cont.)

	TOTAL DELIVERABLE RESIDUE (DRY TONS)										
COUNTY/CROP	WHEAT	CORN	SORGHUM	BARLEY	OATS	RYE	COTTON	ORCHARDS	TOTAL DELIVERABLE AGRICULTURAL RESIDUE	PAPER	TOTAL DELIVERABLE BIOMASS
Thayer	15,500	102,038	11,721	0	0	0	0	0	129,259	1,331	130,589
Thomas	0	400	0	0	0	0	0	0	400	171	571
Thurston	68	36,607	17	0	0	0	0	0	36,691	1,350	38,041
Valley	953	65,761	232	0	0	0	0	0	66,946	1,065	68,011
Washington	420	66,585	601	0	0	0	0	0	67,606	3,041	70,648
Wayne	50	43,798	23	0	0	0	0	0	43,871	1,863	45,733
Webster	6,892	30,157	3,828	0	0	0	0	0	40,977	855	41,832
Wheeler	0	37,315	0	0	0	0	0	0	37,315	190	37,505
York	356	280,315	2,224	0	0	0	0	0	282,895	2,832	285,728
STATE TOTAL	456,102	7,593,989	386,534	1,575	0	0	0	0	8,438,199	304,565	8,742,765

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PLANT 1 LINCOLN, NE
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********** DRY TONS OF BIOMASS DELIVERED **********

COUNTY/CROP	WHEAT	CORN	SORGHUM	BARLEY	OATS	RYE	COTTON	ORCHARDS	PAPER	TOTAL
Cass	7,684	64,892	13,330	0	0	0	0	0	4,201	90,106
Butler	3,812	176,396	23,318	0	0	0	0	0	1,730	205,256
Dodge	650	158,924	2,738	0	0	0	0	0	6,729	169,041
Douglas	127	38,369	195	0	0	0	0	0	79,725	118,415
Fillmore	7,409	253,335	18,686	0	0	0	0	0	1,407	280,837
Gage	19,700	62,020	56,100	0	0	0	0	0	4,410	142,230
Jefferson	15,203	56,419	18,770	0	0	0	0	0	1,730	92,122
Johnson	4,031	17,859	15,441	0	0	0	0	0	912	38,243
Lancaster	20,649	17,726	41,552	0	0	0	0	0	40,223	120,150
Nemaha	5,845	38,417	2,555	0	0	0	0	0	1,578	48,395
Otoe	5,979	34,097	12,603	0	0	0	0	0	2,756	55,436
Pawnee	3,866	5,915	11,063	0	0	0	0	0	665	21,509
Polk	1,356	173,097	8,953	0	0	0	0	0	1,122	184,528
Richardson	5,039	23,722	4,415	0	0	0	0	0	1,939	35,115
Saline	15,670	68,902	29,615	0	0	0	0	0	2,452	116,639
Sarpy	323	26,725	345	0	0	0	0	0	18,667	46,059
Saunders	5,369	142,254	11,613	0	0	0	0	0	3,555	162,791
Seward	5,517	156,055	31,297	0	0	0	0	0	3,022	195,890
Thayer	15,500	102,038	11,721	0	0	0	0	0	1,331	130,589
Washington	420	66,585	601	0	0	0	0	0	3,041	70,648
York	356	280,315	2,224	0	0	0	0	0	2,832	285,728
TOTAL DRY TONS	144,503	1,964,062	317,133	0	0	0	0	0	184,028	2,609,726
TOTAL REVENUE RECEIVED BY RESIDENTS	$5,040,256	$78,562,467	$12,685,326	$0	$0	$0	$0	$0	$1,978,302	$98,266,351

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PLANT 2 NORFOLK, NE
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********** DRY TONS OF BIOMASS DELIVERED **********

COUNTY/CROP	WHEAT	CORN	SORGHUM	BARLEY	OATS	RYE	COTTON	ORCHARDS	PAPER	TOTAL
Antelope	0	195,583	45	0	0	0	0	0	1,597	197,225
Boone	401	188,683	439	0	0	0	0	0	1,331	190,853
Burt	444	119,439	102	0	0	0	0	0	1,578	121,563
Cedar	110	87,937	47	0	0	0	0	0	2,034	90,128
Colfax	822	82,704	610	0	0	0	0	0	1,749	85,886
Cuming	68	90,987	88	0	0	0	0	0	2,091	93,234
Dakota	46	31,747	0	0	0	0	0	0	3,270	35,063
Dixon	46	26,036	24	0	0	0	0	0	1,255	27,362
Knox	347	73,679	1,285	0	0	0	0	0	2,015	77,326
Madison	190	139,296	34	0	0	0	0	0	6,140	145,660
Nance	2,222	80,607	2,215	0	0	0	0	0	836	85,881
Pierce	0	143,891	28	0	0	0	0	0	1,597	145,516
Platte	1,294	241,323	708	0	0	0	0	0	5,779	249,103
Stanton	84	40,328	102	0	0	0	0	0	1,255	41,768
Thurston	68	36,607	17	0	0	0	0	0	1,350	38,041
Wayne	50	43,798	23	0	0	0	0	0	1,863	45,733
Wheeler	0	37,315	0	0	0	0	0	0	190	37,505
TOTAL DRY TONS	6,191	1,659,960	5,768	0	0	0	0	0	35,927	1,707,847
TOTAL REVENUE RECEIVED BY RESIDENTS	$215,934	$66,398,401	$230,735	$0	$0	$0	$0	$0	$386,219	$67,231,290

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PLANT 3 SCOTTS BLUFF, NE
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********** DRY TONS OF BIOMASS DELIVERED **********

COUNTY/CROP	WHEAT	CORN	SORGHUM	BARLEY	OATS	RYE	COTTON	ORCHARDS	PAPER	TOTAL
Banner	6,246	4,280	0	0	0	0	0	0	190	10,716
Box Butte	8,025	59,403	0	0	0	0	0	0	2,661	70,089
Cheyenne	43,727	23,147	26	0	0	0	0	0	1,901	68,801
Dawes	6,341	2,663	0	0	0	0	0	0	1,749	10,753
Kimball	1,153	4,103	81	0	0	0	0	0	855	6,193
Morrill	3,652	57,277	0	0	0	0	0	0	1,084	62,012
Scotts Bluff	1,875	150,955	0	0	0	0	0	0	7,052	159,882
Sioux	982	20,835	0	0	0	0	0	0	304	22,122
TOTAL DRY TONS	72,002	322,662	107	0	0	0	0	0	15,797	410,568
TOTAL REVENUE RECEIVED BY RESIDENTS	$2,511,430	$12,906,486	$4,281	$0	$0	$0	$0	$0	$169,814	$15,592,010

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PLANT 4 WALLACE, NE
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********** DRY TONS OF BIOMASS DELIVERED **********

COUNTY/CROP	WHEAT	CORN	SORGHUM	BARLEY	OATS	RYE	COTTON	ORCHARDS	PAPER	TOTAL
Chase	5,333	167,032	327	0	0	0	0	0	874	173,566
Deuel	25,813	21,444	0	0	0	0	0	0	437	47,694
Dundy	5,000	90,938	1,132	0	0	0	0	0	513	97,584
Frontier	14,879	35,975	1,323	41	0	0	0	0	646	52,864
Hayes	9,475	28,485	50	0	0	0	0	0	228	38,239
Hitchcock	25,057	23,299	4,538	0	0	0	0	0	741	53,635
Keith	0	55,981	115	0	0	0	0	0	1,654	57,750
Lincoln	0	175,124	275	0	0	0	0	0	6,406	181,805
Perkins	2,016	101,580	12	1,534	0	0	0	0	684	105,826
Red Willow	16,742	22,085	0	0	0	0	0	0	2,395	41,222
TOTAL DRY TONS	104,315	721,943	7,772	1,575	0	0	0	0	14,580	850,185
TOTAL REVENUE RECEIVED BY RESIDENTS	$3,638,511	$28,877,717	$310,870	$54,949	$0	$0	$0	$0	$156,736	$33,038,783

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PLANT 5 HYANNIS, NE
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********** DRY TONS OF BIOMASS DELIVERED **********

COUNTY/CROP	WHEAT	CORN	SORGHUM	BARLEY	OATS	RYE	COTTON	ORCHARDS	PAPER	TOTAL
Arthur	60	5,070	0	0	0	0	0	0	95	5,226
Cherry	42	3,406	0	0	0	0	0	0	1,236	4,684
Garden	15,977	15,223	0	0	0	0	0	0	513	31,713
Grant	0	776	0	0	0	0	0	0	152	928
Hooker	0	192	0	0	0	0	0	0	190	382
Logan	763	14,642	0	0	0	0	0	0	190	15,595
McPherson	21	1,222	0	0	0	0	0	0	114	1,357
Sheridan	12,913	36,665	0	0	0	0	0	0	1,388	50,965
Thomas	0	400	0	0	0	0	0	0	171	571
TOTAL DRY TONS	29,776	77,596	0	0	0	0	0	0	4,049	111,420
TOTAL REVENUE RECEIVED BY RESIDENTS	$1,038,581	$3,103,823	$0	$0	$0	$0	$0	$0	$43,526	$4,185,931

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PLANT 6 KEARNY, NE
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********** DRY TONS OF BIOMASS DELIVERED **********

COUNTY/CROP	WHEAT	CORN	SORGHUM	BARLEY	OATS	RYE	COTTON	ORCHARDS	PAPER	TOTAL
Adams	5,116	115,335	4,961	0	0	0	0	0	5,779	131,191
Buffalo	1,399	224,933	1,139	0	0	0	0	0	7,033	234,504
Clay	4,591	168,427	11,255	0	0	0	0	0	1,445	185,718
Custer	5,197	269,006	451	0	0	0	0	0	2,433	277,088
Dawson	1,131	230,113	354	0	0	0	0	0	3,935	235,534
Furnas	19,439	33,190	1,744	0	0	0	0	0	1,122	55,494
Greeley	355	88,069	313	0	0	0	0	0	608	89,345
Gosper	4,419	68,810	936	0	0	0	0	0	399	74,564
Hall	177	183,925	709	0	0	0	0	0	9,238	194,049
Hamilton	953	283,275	3,346	0	0	0	0	0	1,730	289,305
Harlan	13,883	78,804	4,830	0	0	0	0	0	760	98,277
Howard	456	4,475	606	0	0	0	0	0	1,217	6,754
Kearney	7,121	192,374	4,665	0	0	0	0	0	1,274	205,434
Merrick	376	136,270	274	0	0	0	0	0	1,616	138,535
Nuckolls	14,826	37,548	9,897	0	0	0	0	0	1,179	63,450
Phelps	2,087	269,990	517	0	0	0	0	0	1,863	274,457
Sherman	342	46,682	207	0	0	0	0	0	741	47,972
Valley	953	65,761	232	0	0	0	0	0	1,065	68,011
Webster	6,992	30,157	3,828	0	0	0	0	0	855	41,832
TOTAL DRY TONS	89,813	2,527,143	50,266	0	0	0	0	0	44,291	2,711,513
TOTAL REVENUE RECEIVED BY RESIDENTS	$3,132,677	$101,085,719	$2,010,628	$0	$0	$0	$0	$0	$476,133	$106,705,157

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PLANT 7 O'NEILL, NE
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********** DRY TONS OF BIOMASS DELIVERED **********

COUNTY/CROP	WHEAT	CORN	SORGHUM	BARLEY	OATS	RYE	COTTON	ORCHARDS	PAPER	TOTAL
Blaine	0	4,936	0	0	0	0	0	0	133	5,069
Boyd	223	13,083	1,940	0	0	0	0	0	589	15,834
Brown	17	33,160	32	0	0	0	0	0	741	33,949
Garfield	0	16,765	32	0	0	0	0	0	399	17,196
Holt	110	143,690	69	0	0	0	0	0	2,490	146,359
Keya Paha	167	5,048	32	0	0	0	0	0	209	5,455
Loup	21	9,031	0	0	0	0	0	0	152	9,204
Rock	63	21,143	32	0	0	0	0	0	418	21,655
TOTAL DRY TONS	600	246,855	2,135	0	0	0	0	0	5,132	254,723
TOTAL REVENUE RECEIVED BY RESIDENTS	$20,915	$9,874,202	$85,417	$0	$0	$0	$0	$0	$55,174	$10,035,708