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Preliminary Economics for the Production of Pyrolysis Oil from Lignin in a Cellulosic Ethanol Biorefinery

SB Jones
Y Zhu

April 2009

Pacific Northwest
NATIONAL LABORATORY

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Abstract

Cellulosic ethanol biorefinery economics can be potentially improved by converting by-product lignin into high valued products. Cellulosic biomass is composed mainly of cellulose, hemicellulose and lignin. In a cellulosic ethanol biorefinery, cellulose and hemicellullose are converted to ethanol via fermentation. The raw lignin portion is the partially dewatered stream that is separated from the product ethanol and contains lignin, unconverted feed and other by-products. It can be burned as fuel for the plant or can be diverted into higher-value products. One such higher-valued product is pyrolysis oil, a fuel that can be further upgraded into motor gasoline fuels. While pyrolysis of pure lignin is not a good source of pyrolysis liquids, raw lignin containing unconverted feed and by-products may have potential as a feedstock. This report considers only the production of the pyrolysis oil and does not estimate the cost of upgrading that oil into synthetic crude oil or finished gasoline and diesel.

A techno-economic analysis for the production of pyrolysis oil from raw lignin was conducted. comparing two cellulosic ethanol fermentation based biorefineries. The base case is the NREL 2002 cellulosic ethanol design report case where 2000 MTPD of corn stover is fermented to ethanol (NREL 2002). In the base case, lignin is separated from the ethanol product, dewatered, and burned to produce steam and power. The alternate case considered in this report dries the lignin, and then uses fast pyrolysis to generate a bio-oil product. Steam and power are generated in this alternate case by burning some of the corn stover feed, rather than fermenting it. This reduces the annual ethanol production rate from 69 to 54 million gallons/year. Assuming a pyrolysis oil value similar to Btu-adjusted residual oil, the estimated ethanol selling price ranges from $1.40 to $1.48 (2007 $) depending upon the yield of pyrolysis oil. This is considerably above the target minimum ethanol selling price of $1.33 for the 2012 goal case process as reported in the 2007 State of Technology Model (NREL 2008). Hence, pyrolysis oil does not appear to be an economically attractive product in this scenario. Further research regarding fast pyrolysis of raw lignin from a cellulosic plant as an end product is not recommended. Other processes, such as high-pressure liquefaction or wet gasification, and higher value products, such as gasoline and diesel from fast pyrolysis oil should be considered in future studies.

Acknowledgment

The authors acknowledge the DOE EERE Office of Biomass Programs for funding this work and the modeling work performed by the National Renewable Energy Laboratory (NREL), which is publicly available and serves as the basis for cellulose to ethanol portion of the models.

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1.0 Introduction

The “Top Value-Added Chemicals from Biomass” report volumes I and II outline potential renewable fuels and chemicals from biomass (EERE 2004, PNNL 2007). This techno-economic analysis is a continuation of the detailed techno-economic analysis of specific products identified in these two volumes, as described in DOE project 4.5.1.2-10779. The objective of this task is to support the efforts of the Department of Energy’s Office of Energy Efficiency and Renewable Energy, Office of the Biomass Program (EERE OBP) by conducting process and economic modeling of products from biomass sources. Specifically, this report analyzes the cost of producing pyrolysis oil from cellulosic-ethanol-derived raw lignin. Cellulosic ethanol biorefinery economics have the potential to be improved by converting byproduct lignin to make higher valued products than boiler fuel.

Cellulosic biomass is composed mainly of cellulose, hemicellulose and lignin. In a cellulosic ethanol plant, cellulose and hemicellullose are converted to ethanol via fermentation. The raw lignin portion is the partially dewatered stream containing lignin, unconverted feed and by-products. It can be burned as fuel for the plant or can be diverted into higher-value products. One such higher-valued product is pyrolysis oil, a fuel that can be further upgraded into motor gasoline fuels. While pyrolysis of pure lignin is not a good source of pyrolysis liquids, raw lignin containing unconverted feed and by-products may have potential as a feedstock. This report considers only the production of the pyrolysis oil and does not estimate the cost of upgrading that oil into synthetic crude oil or finished gasoline and diesel.

2.0 Process Design Basis

The process flowsheet is based on the cellulosic-ethanol design case of the National Renewable Energy Laboratory (NREL 2002). A simplified block diagram of this process is shown in Figure 1.

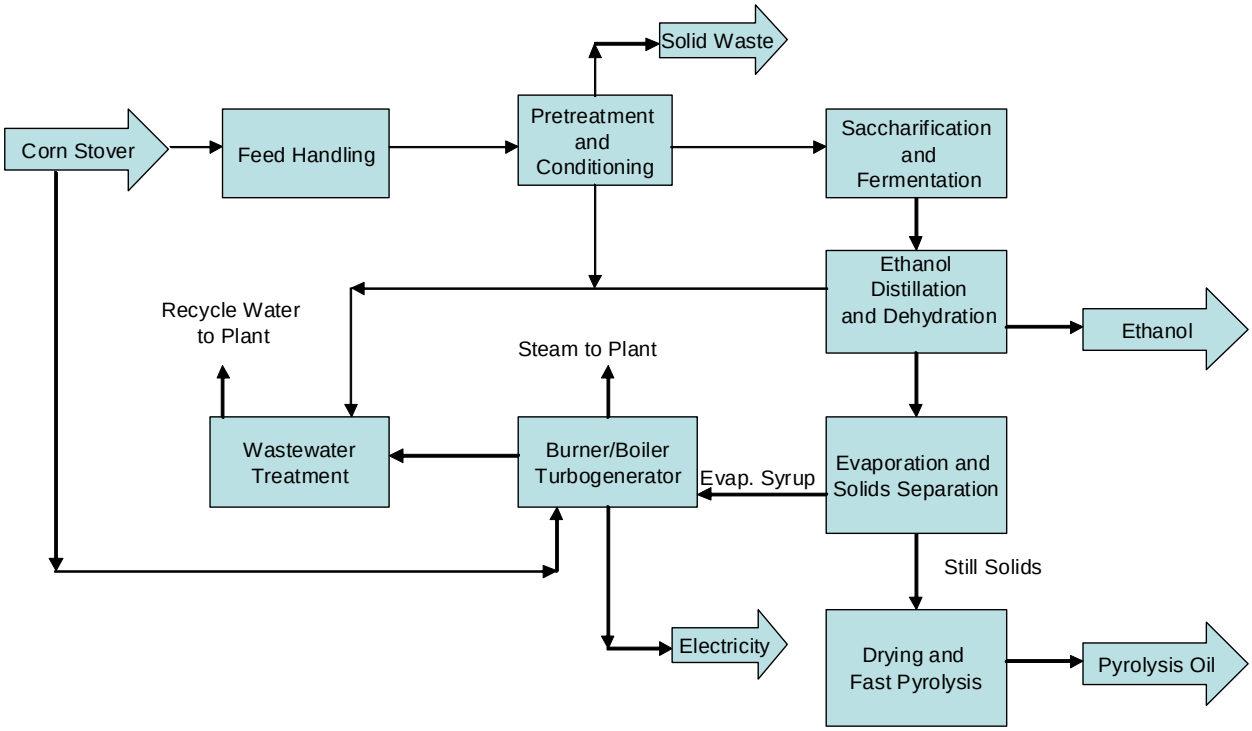

Figure 1. Process Flowsheet for a Cellulosic Ethanol Plant Co-Producing Pyrolysis Oil

Corn stover is washed and shredded. Pre-treatment with steam and dilute sulfuric acid releases the five- and six-carbon sugars in the hemicellulose. The pretreated feed is neutralized, and then sent to enzymatic saccharification to release the six-carbon sugars in the cellulose. This is followed by fermentation of the sugars to ethanol. The dilute ethanol stream is distilled to separate ethanol from the solids and the majority of the water. The ethanol is then dehydrated to 99% ethanol. The distillation-bottoms stream is sent to a triple-effect evaporator to concentrate the solids. Two solid streams are generated: the mainly lignin portion ("still solids") from the first evaporator and the evaporator syrup from the third evaporator. In the base NREL process, both solid streams are sent to the boiler to raise steam for power generation. Also, in the NREL case, all power for the plant is generated onsite and any excess electricity is sold back to the grid. The details of this part of the process can be found in the NREL cellulosic ethanol design report (NREL 2002).

In the process discussed in this report, the lignin-rich "still solids" are sent to the fast-pyrolysis portion of the plant. The evaporator syrup supplies insufficient fuel to generate power for the entire plant; therefore, a portion of the corn stover feedstock is diverted to the boiler. The total feed rate of corn stover is maintained at 2000 dry mtpd. This size of plant is consistent with a delivered-feedstock cost of $46/dry

short ton (NREL 2008). At this price, the feedstock is assumed to "reactor-throat ready." That is, it has already been washed and size-reduced.

Figure 2 shows the equipment flow diagram for the fast-pyrolysis system. Wet lignin containing solids from the first evaporator are dried from 50% moisture to 8% moisture using hot exhaust gases. The fast- pyrolysis reactor system is assumed to be a circulating fluidized-bed reactor using hot sand to provide the heat for the endothermic pyrolysis reactions. The reactor residence time is less than 1 second. During this time, the lignin and other solids in the feed break down into non-condensable gases, water, char and organic vapor. The reactor effluent enters a cyclone to separate sand, char, and unconverted solids from the vapor product. The vapor product is then rapidly quenched with cooled pyrolysis oil product to prevent further reaction. A portion of the non-condensable gases is recycled to the pyrolysis reactor to help fluidize the bed. The remainder is burnt with the char to provide reheat to the circulating sand. Hot exhaust flue gases from the sand heater are sent to the dryer to dry the incoming wet feed.

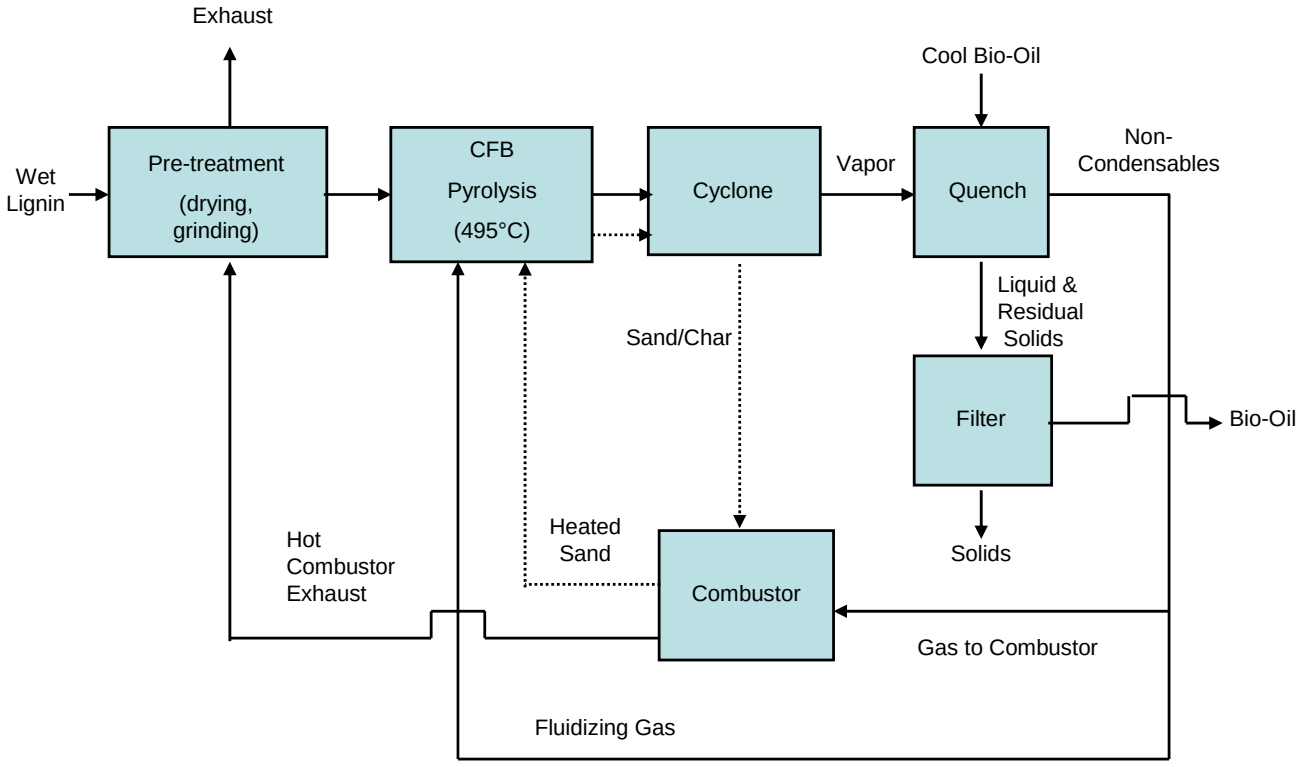

Figure 2 Process Flowsheet for the Fast Pyrolysis System

Three cases were modeled: the base case, the base pyrolysis case and a pyrolysis case with high char formation. The base case is the same as the state-of-technology case (NREL 2008). Here the plant produces only ethanol and by-product electricity. Since no experimental data exist for a lignin feed stream derived from a cellulosic ethanol plant, two cases pyrolysis cases were analyzed. One with high char yield and one with low char yield. In the high char case, the excess heat not needed by the dryer was recuperated into steam for use in the plant.

3.0 Process Flow Assumptions

The flowsheet was modeled using the CHEMCAD process flow software. The simulation assumptions for all parts of the process except the fast-pyrolysis unit are those given in the NREL design report (NREL 2002). The fast-pyrolysis process is similar to that described in the PNNL Pyrolysis design report (PNNL 2008). Table 1 lists the assumptions and sources for the fast-pyrolysis reactor. No data were found for fast pyrolysis of raw lignin from a cellulosic ethanol plant. Thus the operating conditions were estimated from two extremes: sorghum bagasse containing approximately 25% lignin and milled wood lignin. The model feed on a dry basis is approximately 60% lignin with the remainder being ash and unconverted feed. Pyrolysis of whole lignocellulosic feedstocks is well documented and results in high conversions and yields as high as 75% (wet) of pyrolysis oil (IEA 2007). At the other extreme is pure lignin. Pyrolysis of pure lignin feedstock is not easily done. Ferdous et. al. reports the pyrolysis of Alcell lignin at 520°C to have a 50% conversion with half the product being char and the remainder equally split between gas and liquid products (Ferdous 2001) .

Table 1. Process Assumption Summary for Fast Pyrolysis

Process Area	Process Parameter	Low Char Case	High Char Case	Literature Values	Source
Lignin stream	Water	45%	45%		
	Lignin	33%	33%		
	Ash	10%	10%		
	Bio-solids and by-products	12%	12%		
Pyrolysis feed dryer	% Moisture to pyrolysis reactor	8%	8%	8%	PNNL 2008
Fast pyrolysis reactor	Temperature	490ºC	499ºC	510ºC	Piskorz 1998[(a)]
	Gas yield	13%	19%	12.40%	Piskorz 1998[(a)]
	Char yield	26%	44%	14.20%	Piskorz 1998[(a)]
	Water yield	8%	6%	11.20%	Piskorz 1998[(a)]
	Pyrolysis oil yield	53%	31%	62.20%	Piskorz 1998[(a)]
Pyrolysis oil Wet basis	C	66%	54%	55%	Nunn 1985[(b)]
	H	9%	9%	5%	Nunn 1985[(b)]
	O	25%	37%	31%	Nunn 1985[(b)]

(a) Sorghum bagasse
(b) milled wood lignin

4.0 Economic Assumptions

The capital and operating costs are calculated in a Microsoft Excel spreadsheet using results from the CHEMCAD process simulation. A simple return-on-investment calculation is used to estimate the product selling price. All capital costs are reported in year-2007 dollars to be consistent with the current state of technology values (NREL 2008). The total capital investment is factored from installed equipment costs (NREL 2002). The operating labor was determined by assuming one operator per shift per major processing area. Most labor categories (control lab, supervisory, administrative) are factored from the operating labor. Maintenance materials, labor and local taxes and insurance are factored from the capital investment. These data and their sources are summarized in Table 2.

Table 2 Economic Assumptions

	Value	Units or Basis	Reference
Stream factor	96%		NREL 2002
Construction	Overnight[(a)]		
Plant life	20	Years	NREL 2002
Depreciation	20	Years straight line	
Rate of return on capital	10%		
Labor			
Operating labor	42	$/hr Burdened with 10% shift overlap	SRI PEP 2007
Maintenance labor	1.0%	Of total installed capital (TIC)	SRI PEP 2007
Control lab labor	20%	Of operating labor	SRI PEP 2007
Operator per shift per major unit	1		
Materials			
Maintenance	1.0%	Of TIC	SRI PEP 2007
Operating supplies	10%	Of operating labor	SRI PEP 2007
Overhead	80%	Of total labor	SRI PEP 2007
Local taxes and insurance	2%	Of total fixed capital	SRI PEP 2007
General and administrative	5%	Of product value	SRI PEP 2007

(a) "Overnight construction" means no costs are associated with the construction phase, that is, construction is as if it happens "overnight."

5.0 Analysis and Results

Table 3 summarizes the raw material consumption and by-product electricity generation for each case. Three cases are considered:

- Base Case: the lignin is burned in the boiler to produce plant steam and power,
- Fast Pyrolysis Low Char Case: the lignin is dried and then fast pyrolyzed with a minimum of char formation, some corn stover is diverted from fermentation for use as boiler feed, and
- Fast Pyrolysis High Char Case: the lignin is dried and then fast pyrolyzed with a maximum of char formation and some corn stover is diverted from fermentation for use as boiler feed.

The high-char-formation case was modeled to account for uncertainty in the pyrolysis yields. No data are available specifically for fast-pyrolysis yields from cellulosic ethanol lignin. Thus a worst case was modeled where the process yields more char than oil.

Chemical consumption per gallon of ethanol produced as shown in Table 3 is nearly the same for each case. However, the costs associated with each item are increased in the high and low char cases due to the reduced ethanol yield as compared with the base case. The fast pyrolysis oil produced in the high and low char cases are taken as an operating credit. It is assumed that the pyrolysis oil has the same value as residual oil with the price adjusted proportionately to reflect the difference in heating values of the two oils. All three cases generate power slightly in excess of that needed by the plant. Credit is taken for the excess power under the assumption that it can be sold to the grid.

Table 4 summarizes the yields and capital and operating costs for each case. Note that each case assumes a feed rate of 2000 MTPD dry stover to the plant gate. In the base case, most of the cellulosic and hemicellulosic material is fermented to ethanol. The lignin and any unconverted sugars are sent to the boiler to generate steam and power. When lignin is diverted from the boiler to a fast pyrolysis unit, another fuel must be substituted in the boiler. While additional stover above 2000 mtpd could have been brought into the plant to serve as boiler fuel, the price will likely be higher than the $46/ton assumed here. This is due to the additional transportation costs needed to widen the biomass collection area in order to increase the federate to the plant. Thus, in the fast pyrolysis scenario, a small portion of the corn stover was diverted from fermentation to the boiler. This reduces the available amount of cellulose and hemicellulose in the fermentation step, resulting in a 22% reduction in ethanol yield for the pyrolysis case. Routing part of the feed to the boiler also affects the capital costs. The capital cost of adding a pyrolysis unit is more than offset by the reduction in capital for the pretreatment, fermentation and product-separation portions of the plant. However, the value of pyrolysis oil is not sufficient to justify the reduction in ethanol yield, as can be seen by the estimated selling price.

It appears that producing pyrolysis oil from lignin will likely increase the selling price of ethanol by approximately 7-15 cents/gallon.

Table 3 Raw Material Consumption and By-Product Production

			Base Case No Pyrolysis Oil			Pyrolysis with Low Char Formation Case			Pyrolysis with High Char Formation Case		
	Unit Cost		Consumption /gal EtOH		¢/gal	Consumption /gal EtOH		¢/gal	Consumption /gal EtOH		¢/gal
Raw Materials[a]											
Corn stover	46	$/dry ton	0.011	st	51.20	0.014	st	66.11	0.014	st	66.11
Clarifier polymer	1.299	$/lb	0.000	lb	0.00	0.010	lb	1.23	0.010	lb	1.23
Sulfuric acid	0.013	$/lb	0.895	lb	1.16	0.895	lb	1.11	0.895	lb	1.11
Lime	0.036	$/lb	0.652	lb	2.36	0.652	lb	2.27	0.652	lb	2.27
Corn steep liquor	0.084	$/lb	0.351	lb	2.94	0.351	lb	2.83	0.351	lb	2.83
Purchased cellulase	0.057	$/lb	1.825	lb	10.48	1.825	lb	10.08	1.825	lb	10.08
Diammonium phosphate	0.073	$/lb	0.044	lb	0.32	0.044	lb	0.31	0.044	lb	0.31
Propane	0.002	$/lb	0.005	lb	0.00	0.005	lb	0.00	0.005	lb	0.00
Make-up water	0.000	$/lb	46.187	lb	0.56	46.187	lb	0.54	46.187	lb	0.54
BFW Chemicals	1.403	$/lb	0.000	lb	0.04	0.000	lb	0.04	0.000	lb	0.04
Cooling water chemicals	1.061	$/lb	0.001	lb	0.06	0.001	lb	0.06	0.001	lb	0.06
WWT Chemicals	0.164	$/lb	0.013	lb	0.22	0.013	lb	0.21	0.013	lb	0.21
WWT Polymer	2.652	$/lb	0.000	lb	0.01	0.000	lb	0.01	0.000	lb	0.01
Ash disposal	0.009	$/lb	1.214	lb	1.14	1.214	lb	1.14	1.214	lb	1.14
Gypsum disposal	0.009	$/lb	1.966	lb	1.84	1.966	lb	1.84	1.966	lb	1.84
Gross Raw Material Cost					**72.32**			**87.76**			**87.76**
By-product credits:[b]											
Pyrolysis oil	120	¢/gal	0.00	gal	0.00	-0.20	gal	-29.22	-0.08	gal	-20.19
Utilities											
Electricity[c]	4	¢/kwh	-2.12	kwh	-8.49	-1.48	kwh	-5.20	-2.54	kwh	-6.41

(a) Unit costs from NREL design case escalated to 2007 with the design-case worksheet (NREL 2002).
(b) Pyrolysis oil value based on the 2007 EIA price for residual oil and adjusted for BTU content.
(c) Electricity costs from NREL design case escalated to 2007 with the design-case worksheet (NREL 2002).

The capital and operating costs are shown in Table 4.

Table 4 Capital and Operating Costs

	Base Case	Low Char Formation Case	High Char Formation Case
Ethanol, million gal/yr	69	54	54
MTPD dry stover	2000	2000	2000
Investment, U.S. $ million			
Total installed capital	135	127	127
Total indirect costs	85	80	80
Total fixed capital	220	207	207
Production costs, U.S. $/gal			
Raw materials	0.72	0.88	0.88
By-products	0.00	-0.29	-0.20
Utilities	-0.08	-0.05	-0.06
Variable costs, U.S. $/gal	0.64	0.53	0.61
Maintenance materials	0.04	0.05	0.05
Operating supplies	0.00	0.00	0.00
Operating labor	0.03	0.04	0.04
Maintenance labor	0.02	0.02	0.02
Control laboratory	0.01	0.01	0.01
Total direct costs, U.S. $/gal	0.73	0.66	0.74
Plant overhead	0.03	0.04	0.04
Taxes and insurance	0.03	0.04	0.04
Depreciation	0.16	0.19	0.19
Plant gate cost, U.S. $/gal	0.95	0.93	1.01
	0.00	0.00	0.00
General and administrative, sales and research	0.07	0.08	0.08
		0.00	
Production costs, U.S. $/gal	1.02	1.02	1.09
Selling price, U.S. $/gal (10% ROI)	1.33	1.40	1.48

6.0 Conclusions and Recommendations

A techno-economic analysis (TEA) using a CHEMCAD-based process model and Excel-based production-cost spreadsheet of cellulosic-derived lignin conversion to pyrolysis oil was performed. Fast pyrolysis of raw lignin from a cellulosic plant has not been demonstrated. Furthermore, the minimum amount of cellulosic material needed in the lignin stream to allow high conversions and high yields of liquid products is not known. However, this screening study suggests that producing fast pyrolysis oil as an end product in a biorefinery is too low of a value fuel to positively impact ethanol economics. Thus further research into fast pyrolysis as an end product is not recommended. If a higher valued product could be produced, then this option may have merit. Examples of higher valued products are upgrading the fast pyrolysis oil to gasoline or extracting chemicals such as levoglucosan. Estimating the economics for these higher valued products is beyond the scope of this work. However, this work can serve as a basis for future biorefinery studies.

Upgrading the raw lignin stream from an ethanol biorefinery to valuable products has the potential to improve the economics of a cellulosic biorefinery. It is recommended that techno-economic work be continued to identify those products worth pursuing. Since the lignin has high moisture content, it is recommended that future studies consider wet processing methods such as high-pressure liquefaction or gasification for fuels production. Upgrading fast pyrolysis oil and chemical production should also be considered.

7.0 References

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8.0 Appendix: Heat and Material Balance for the High Char Case

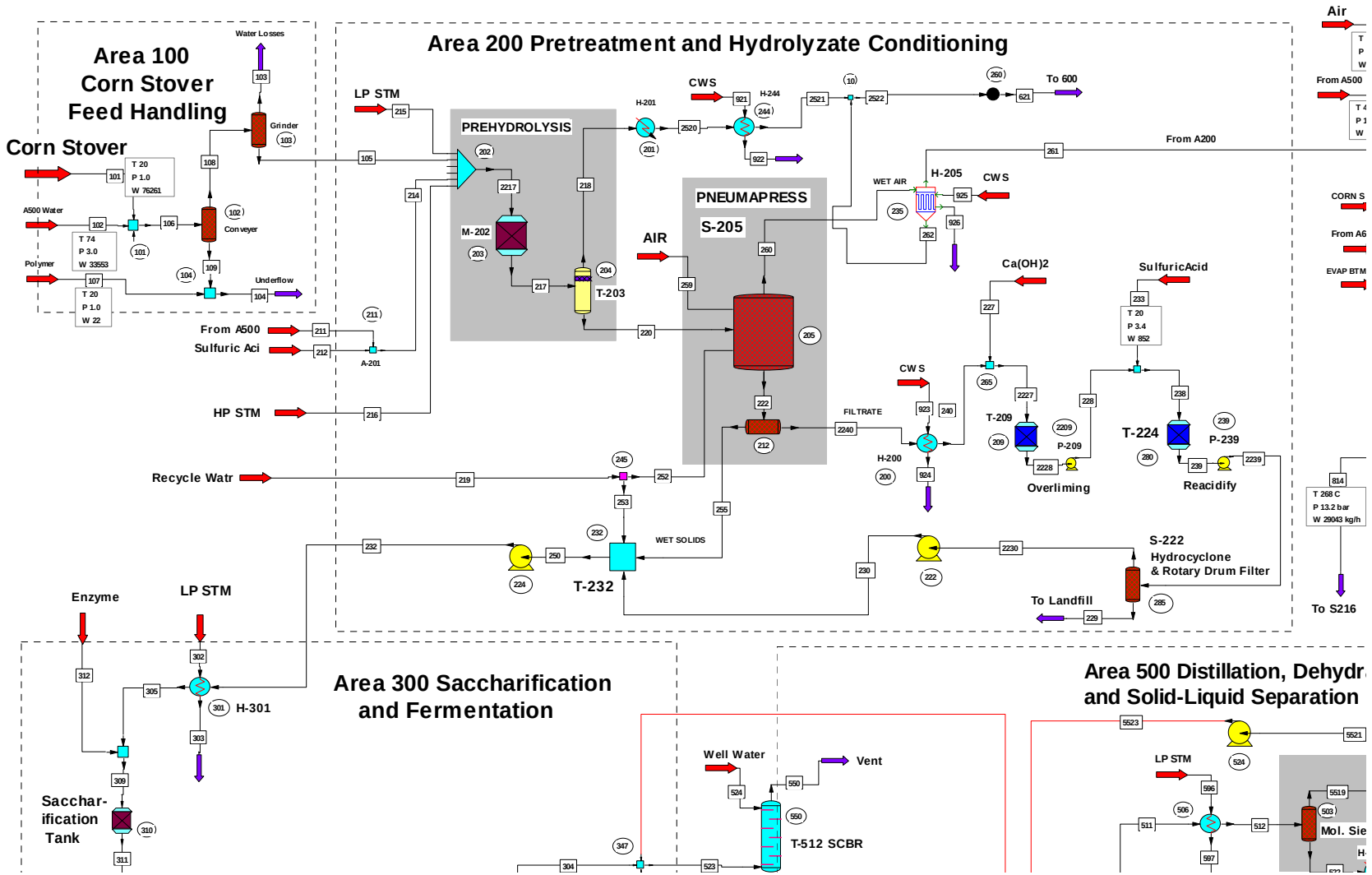

Figure 3 Process Flowsheet for the High Char Case

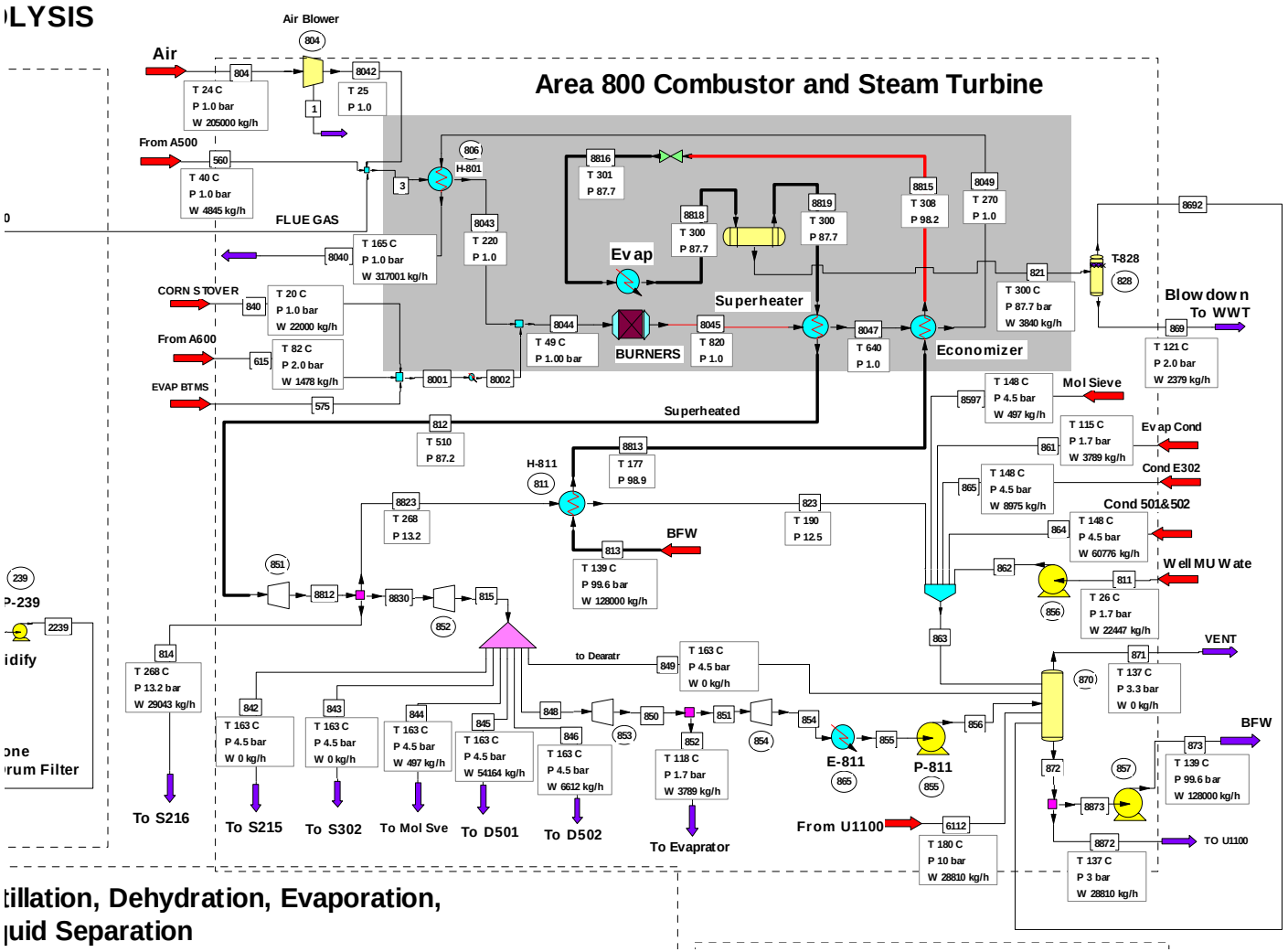

Figure 3, cont. Process Flowsheet for the High Char Case

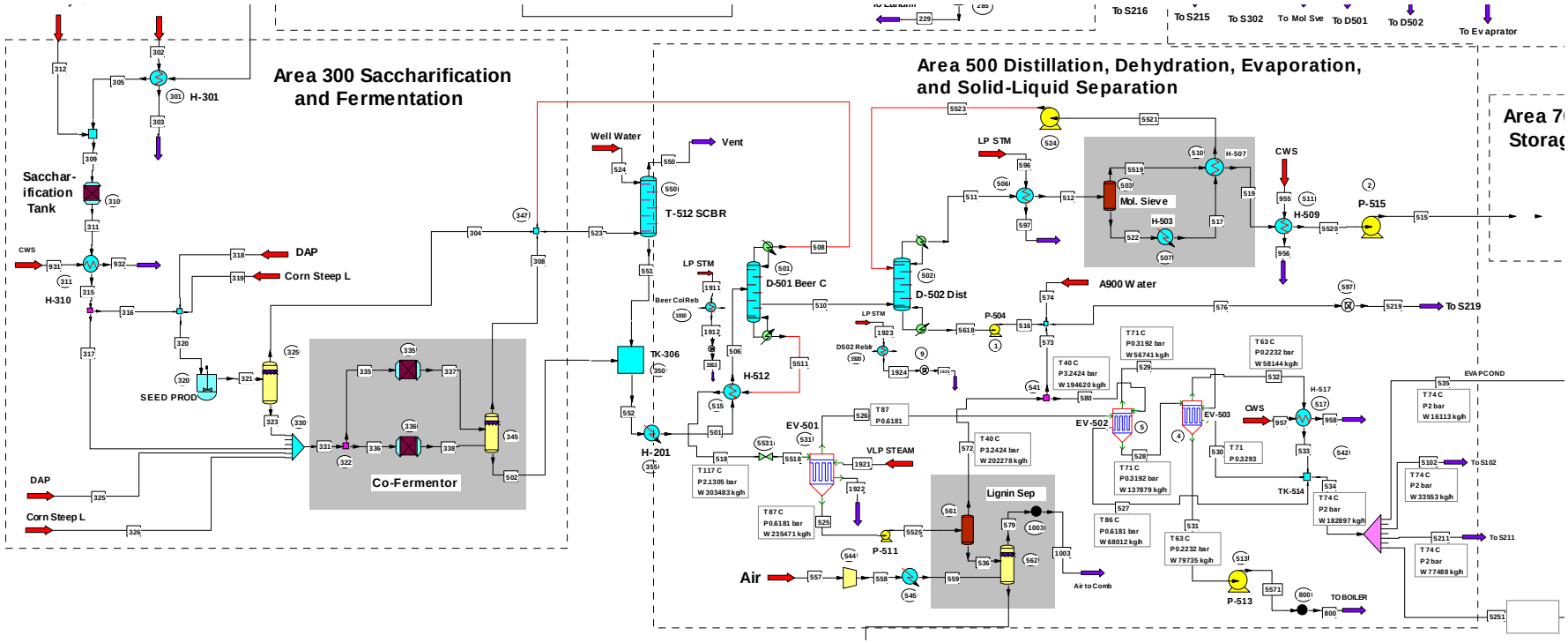

Figure 3, cont. Process Flowsheet for the High Char Case

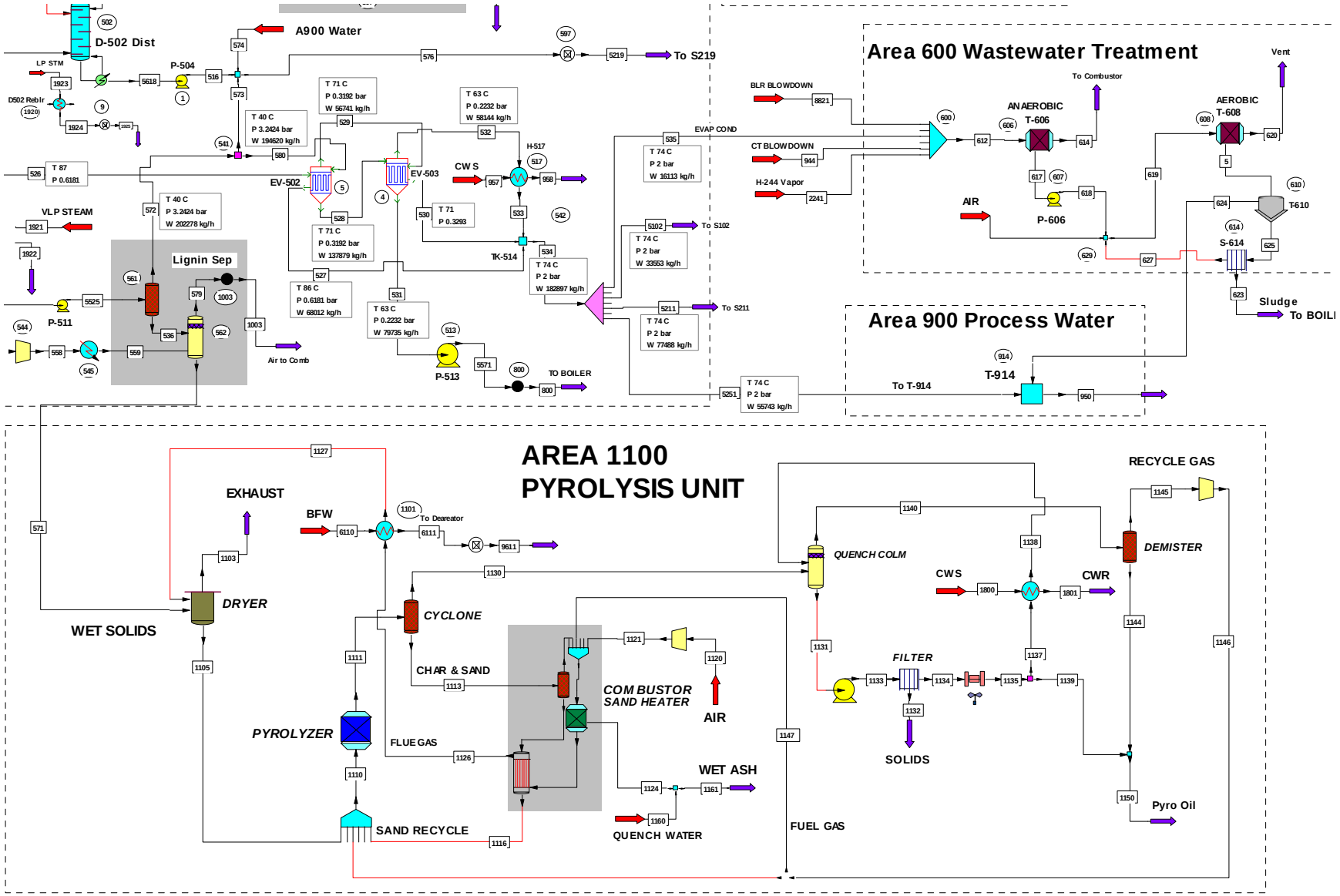

Figure 3, cont. Process Flowsheet for the High Char Case

Table 5 Heat and Material Balance for the High Char Case

Stream No.	1	3	5	101	102	103	104	105	106	107	108	109	125	211	212
Stream Name				Corn Stover	A500 Water		Underflow	Underflow		Polymer	Water Losses	Underflow		From A500	SulfuricAcid
Temp C	25.0489	25.6756	21	20	73.8	45	-26.44	45	-27.7742	20	-27.7742	-27.7742	1596.2098	74	20
Pres bar	1.0234	1	0.9818	1.0132	3.0397	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132	1.5648	3.0397	3.4474
Enth MW	0	-1.4844	-309.27	-163.13	-144.29	-38.56	-3.4701	-260.41	-307.41	-0.09766	-304.04	-3.3724	-12.916	-334.29	-3.653
Vapor mass fraction	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
Total kg/h	0	213776.27	70051.4874	76261	33553	8912.7038	786.3577	100137.043	109814	22.14	109049.758	764.2178	116142.716	77487.0003	1641.1199
Flowrates in kg/h															
Glucose	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cellulose	0	0	0	24261.5609	0	0	0	24261.5609	24261.5609	0	24261.5609	0	0	0	0
Xylose	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Xylan	0	0	0	13666.3191	0	0	0	13666.3191	13666.3191	0	13666.3191	0	0	0	0
Lignin	0	0	0	11670.1175	0	0	0	11670.1175	11670.1175	0	11670.1175	0	0	0	0
Acetate	0	0	0	1901.7093	0	0	0	1901.7093	1901.7093	0	1901.7093	0	0	0	0
Organism	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SolsIds	0	0	0	5768.6186	0	0	0	5768.6186	5768.6186	0	5768.6186	0	0.0004	106.8592	0
Gypsum	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lgnsol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HMF	0	0.0001	0	0	0.0282	0.008	0	0.0201	0.0282	0	0.0282	0	0	0	0
C5Sugar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C6Sugar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C5Solid	0	0	0	1895.8035	0	0	0	1895.8035	1895.8035	0	1895.8035	0	0	0	0
C6Solid	0	0	0	2267.8775	0	0	0	2267.8775	2267.8775	0	2267.8775	0	0	0	0
CaH2O2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ash	0	0	0	3390.0019	0	0	0	3390.0019	3390.0019	0	3390.0019	0	0	0	0
Ethanol	0	1.1023	0.0009	0	26.0112	6.7131	0.8402	18.4579	26.0112	0	25.171	0.8402	0	55.3796	0
Water	0	391.1629	70051.4378	11438.9706	32763.9479	8704.2143	769.1693	34751.6747	44202.9202	22.14	43455.889	747.0293	4763.5916	76639.144	0
Furfural	0	4.1699	0	0	39.0794	10.5845	0.8129	27.682	39.0794	0	38.2665	0.8129	0	99.8393	0
Sulfuric Acid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1641.1199
Nitrogen	0	168469	0.0039	0	0	0	0	0	0	0	0	0	84475.1648	0	0
Carbon Dioxide	0	17.9352	0.0033	0	0	0	0	0	0	0	0	0	22960.5251	0	0
Oxygen	0	44890.871	0.0382	0	0	0	0	0	0	0	0	0	3906.7875	0	0
Ammonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lactic Acid	0	0.0009	0.005	0	1.3482	0	0	1.3482	1.3482	0	1.3482	0	0	0	0
Acetic Acid	0	2.0409	0	0	722.5768	191.184	15.5354	515.8574	722.5768	0	707.0414	15.5354	0	585.7761	0
Methane	0	0	0	0	0	0	0	0	0	0	0	0	0.0001	0	0
Nitrogen Dioxide	0	0	0	0	0	0	0	0	0	0	0	0	0.4508	0	0
Sulfur Dioxide	0	0	0	0	0	0	0	0	0	0	0	0	7.6998	0	0
DAP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2-2-4-TriMth-C5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0	0	0	0	0	0	0	0.2433	0	0
Carbon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Monoxide	0	0	0	0	0	0	0	0	0	0	0	0	28.2569	0	0

Stream No.	214	215	216	217	218	219	220	222	227	228	229	230	232	233	238
Stream Name		LP STM	HP STM			Recycle Watr			Ca(OH)2		To Landfill			SulfuricAcid	
Temp C	73.6046	163.2652	267	190	101.1	36.7532	101.1	50	20	50.0325	52.5328	52.5652	50.5251	20	49.991
Pres bar	3.0397	4.4786	13.1722	38.7669	1.0132	1.0132	1.0132	1	1.0132	2.0265	1.0132	2.0265	2.0265	3.4474	2.0265
Enth MW	-337.94	-32.867	-105.1	-738.38	-144.88	-688.79	-586.94	-1149.4	-8.6251	-926.06	-20.826	-907.12	-1270.7	-1.8954	-927.96
Vapor mass fraction	0	1	1	0	1	0	0	0	0	0	1.78E-06	0	0	0	0
Total kg/h	79128.1188	8975.0001	29042.5201	217282.709	39835.1765	161535	177447.532	308015.669	2331.7899	238116	6133.3985	232834	335687.526	851.52	238967.372
Flowrates in kg/h															
Glucose	0	0	0	1887.0023	0	14.8202	1887.0023	1899.013	0	1771.9691	9.3511	1762.618	1892.4713	0	1771.9691
Cellulose	0	0	0	22223.5898	0	5.4601	22223.5898	22228.0159	0	111.1394	110.5837	0.5557	22118.468	0	111.1394
Xylose	0	0	0	13976.8518	0	163.8025	13976.8518	14109.602	0	13169.903	69.5009	13100.4023	14071.1538	0	13169.903
Xylan	0	0	0	341.6581	0	0.78	341.6581	342.2903	0	1.7114	1.7029	0.0086	340.7352	0	1.7114
Lignin	0	0	0	11086.6117	0	55.3808	11086.6117	11131.4934	0	55.6571	55.3788	0.2783	11086.6135	0	55.6571
Acetate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Organism	0	0	0	0	0	106.0816	0	85.9718	0	0	0	0	106.0816	0	0
Solslds	106.8592	0	0	5875.4781	0	1723.0453	5875.4781	7271.887	0	6861.7527	36.2112	6825.5415	7562.3115	0	6861.7527
Gypsum	0	0	0	0	0	0	0	0	0	2728.0646	4201.7444	21.1142	21.1142	0	2728.0646
Lgnsol	0	0	0	583.5059	0	173.9427	583.5059	724.4744	0	683.8315	3.6087	680.2227	753.8398	0	683.8315
HMF	0	0	0	88.1958	0.1608	36.6606	88.035	117.7457	0	112.9064	0.5958	112.3106	124.0996	0	112.9064
C5Sugar	0	0	0	2380.9848	0	155.2223	2380.9848	2506.7818	0	2341.334	12.3558	2328.9784	2523.8513	0	2341.334
C6Sugar	0	0	0	2708.2656	0	443.8268	2708.2656	3067.9568	0	2865.4715	15.1218	2850.3496	3136.9709	0	2865.4715
C5Solid	0	0	0	222.7605	0	0	222.7605	222.7605	0	0	0	0	222.7605	0	0
C6Solid	0	0	0	56.697	0	0	56.697	56.697	0	0	0	0	56.697	0	0
CaH2O2	0	0	0	0	0	0	0	0	2331.7899	1157.7868	511.9401	2.5725	2.5725	0	1157.7868
Ash	0	0	0	3390.0019	0	17.9403	3390.0019	3404.5414	0	17.0227	16.9376	0.0851	3391.0043	0	17.0227
Ethanol	55.3796	0	0	73.8375	58.0866	21.8403	15.7509	32.7729	0	31.911	0.1684	31.7426	36.7448	0	31.911
Water	76639.144	8975.0001	29042.5201	147175.543	38990.1268	156542.14	108185.416	234728.608	0	202007.447	1066.0438	200941.406	263338.068	0	202007.447
Furfural	99.8393	0	0	565.9027	344.9017	234.7835	221.001	407.3621	0	392.6971	2.0724	390.6247	449.7974	0	392.6971
Sulfuric Acid	1641.1199	0	0	1641.1199	0	28.0804	1641.1199	1663.8773	0	0	0	0	115.1391	851.52	851.52
Nitrogen	0	0	0	0	0	0	0	1.8626	0	1.8626	0.0098	1.8527	1.8527	0	1.8626
Carbon Dioxide	0	0	0	0	0	22.6203	0	0.3966	0	0.3966	0.0021	0.3945	4.6827	0	0.3966
Oxygen	0	0	0	0	0	0	0	1.0972	0	1.0972	0.0058	1.0914	1.0914	0	1.0972
Ammonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lactic Acid	0	0	0	1.3482	0.0023	742.5714	1.3459	603.1483	0	571.7846	3.0174	568.7671	740.8992	0	571.7846
Acetic Acid	585.7761	0	0	3003.3522	441.8991	1045.9956	2561.4532	3407.3079	0	3230.1278	17.0462	3213.0816	3588.55	0	3230.1278

Stream No.	239	240	250	252	253	255	259	260	261	262	302	303	304	305	308
Stream Name						WET SOLIDS	AIR		WET AIR	To combustor	TO 600		LP STM		
Temp C	52.4998	50	50.4926	36.7532	36.7532	50	40	50	38	38	163.26	147.741	41	65	41
Pres bar	1.0132	1	1	1.0132	1.0132	1	9.6259	1	1	1	4.4786	4.4786	1.0132	2.0265	1.0132
Enth MW	-927.96	-916.35	-1270.7	-558.21	-130.57	-233	-0.0016604	-1.2258	-0.65558	-0.68983	-29.141	-33.91	-4.0549	-1265.9	-43.769
Vapor mass fraction	1.77E-06	1.76E-06	0	0	0	0	1	1	1	0	1	0.0003125	1	0	1
Total kg/h	238967.372	235784.061	335687.526	130913	30622.0067	72231.587	3744.6703	4089.5237	3931.4011	158.1227	7957.6491	7957.6491	1637.2007	335687.526	17656.106
Flowrates in kg/h															
Glucose	1771.9691	1771.9691	1892.4713	12.0108	2.8095	127.044	0	0	0	0	0	0	0	1892.4713	0
Cellulose	111.1394	111.1394	22118.468	4.425	1.0351	22116.8769	0	0	0	0	0	0	0	22118.468	0
Xylose	13169.903	13169.903	14071.1538	132.7506	31.0519	939.6995	0	0	0	0	0	0	0	14071.1538	0
Xylan	1.7114	1.7114	340.7352	0.6321	0.1479	340.5788	0	0	0	0	0	0	0	340.7352	0
Lignin	55.6571	55.6571	11086.6135	44.8823	10.4985	11075.8362	0	0	0	0	0	0	0	11086.6135	0
Acetate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Organism	0	0	106.0816	85.9718	20.1098	85.9718	0	0	0	0	0	0	0	106.0816	0
Solslds	6861.7527	6861.7527	7562.3115	1396.4096	326.6358	410.1344	0	0	0	0	0	0	0	7562.3115	0
Gypsum	4222.8586	0	21.1142	0	0	0	0	0	0	0	0	0	0	21.1142	0
Lgnsol	683.8315	683.8315	753.8398	140.9685	32.9741	40.643	0	0	0	0	0	0	0	753.8398	0
HMF	112.9064	112.9064	124.0996	29.7109	6.9497	4.8393	0	0.0001	0	0.0001	0	0	0	124.0996	0.0001
C5Sugar	2341.334	2341.334	2523.8513	125.797	29.4253	165.4476	0	0	0	0	0	0	0	2523.8513	0
C6Sugar	2865.4715	2865.4719	3136.9709	359.691	84.1357	202.4852	0	0	0	0	0	0	0	3136.9709	0
C5Solid	0	0	222.7605	0	0	222.7605	0	0	0	0	0	0	0	222.7605	0
C6Solid	0	0	56.697	0	0	56.697	0	0	0	0	0	0	0	56.697	0
CaH2O2	514.5127	0	2.5725	0	0	0	0	0	0	0	0	0	0	2.5725	0
Ash	17.0227	17.0227	3391.0043	14.5394	3.4009	3387.5186	0	0	0	0	0	0	0	3391.0043	0
Ethanol	31.911	31.911	36.7448	17.7001	4.1402	0.8619	0	0.6781	0.643	0.0351	0	0	41.8156	36.7448	525.2215
Water	202007.447	202007.447	263338.068	126866.625	29675.5171	32721.1684	0	323.4317	166.9911	156.4406	7957.6491	7957.6491	52.606	263338.068	565.3127
Furfural	392.697	392.6971	449.7974	190.2759	44.5076	14.665	0	3.9147	3.6061	0.3087	0	0	0.5099	449.7974	5.3992
Sulfuric Acid	0	1554.0614	115.1391	22.7572	5.3232	109.8159	0	0	0	0	0	0	0	115.1391	0
Nitrogen	1.8626	1.8626	1.8527	0	0	0	2872.4811	2870.6182	2870.6167	0.0016	0	0	0.1852	1.8527	1.667
Carbon Dioxide	0.3966	0.3966	4.6827	18.3322	4.2881	0	0	17.9356	17.9352	0.0004	0	0	1534.2887	4.6827	16522.6496
Oxygen	1.0972	1.0972	1.0914	0	0	0	872.1891	871.0919	871.091	0.0009	0	0	7.523	1.0914	32.9163
Ammonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lactic Acid	571.7845	571.7846	740.8992	601.803	140.7684	31.3637	0	0.0005	0	0.0005	0	0	0.0001	740.8992	0.0017
Acetic Acid	3230.1278	3230.1281	3588.55	847.7074	198.2882	177.18	0	1.8528	0.5181	1.3347	0	0	0.2721	3588.55	2.94

Stream No.	309	311	312	315	316	317	318	319	320	321	323	325	326	331	335
Stream Name			Enzyme				DAP	Corn Steep L				DAP	Corn Steep L		
Temp C	64.216	65	20	41	41	41	20	20	40.37	41	41	20	20	40.9352	40.9352
Pres bar	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132	1.0132
Enth MW	-1288.1	-1287.8	-22.177	-1295.7	-129.57	-1166.2	-0.3511	-3.7405	-133.66	-134.01	-129.95	-0.35186	-3.7592	-1300.2	-39.007
Vapor mass fraction	1.50E-06	1.74E-06	0	0	0	0	0	0	0	0.049335	0	0	0	0	0
Total kg/h	341010.404	341010.404	5322.84	341010.404	34101.046	306909.443	106	848	35055.0465	35055.0713	33417.8721	106.23	852.23	341286	10238.5711
Flowrates in kg/h															
Glucose	1892.4713	24256.6032	0	24256.6032	2425.6603	21830.9419	0	0	2425.6603	157.6677	157.6677	0	0	21988.6113	659.6584
Cellulose	22118.468	840.5	0	840.5	84.05	756.45	0	0	84.05	84.05	84.05	0	0	840.5	25.215
Xylose	14071.1538	14071.152	0	14071.152	1407.1153	12664.0367	0	0	1407.1153	196.9963	196.9963	0	0	12861.0323	385.8309
Xylan	340.7352	340.7352	0	340.7352	34.0735	306.6617	0	0	34.0735	34.0735	34.0735	0	0	340.7352	10.2221
Lignin	11086.6135	11086.6135	0	11086.6135	1108.6614	9977.9522	0	0	1108.6614	1108.6614	1108.6614	0	0	11086.6135	332.5984
Acetate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Organism	549.4741	549.4741	443.3925	549.4741	54.9474	494.5267	0	0	54.9474	169.1464	169.1464	0	0	663.6731	19.9102
SolsIds	7562.3115	7562.3115	0	7562.3115	756.2312	6806.0804	0	0	756.2312	756.2311	756.2311	0	0	7562.3115	226.8693
Gypsum	21.1142	21.1142	0	21.1142	2.1114	19.0028	0	0	2.1114	2.1114	2.1114	0	0	21.1142	0.6334
Lgnsol	753.8398	753.8397	0	753.8397	75.384	678.4557	0	0	75.384	75.384	75.384	0	0	753.8397	22.6152
HMF	124.0996	124.0996	0	124.0996	12.41	111.6896	0	0	12.41	12.41	12.4099	0	0	124.0996	3.723
C5Sugar	2523.8513	2523.8513	0	2523.8513	252.3851	2271.4661	0	0	252.3851	280.5274	280.5274	0	0	2551.9937	76.5598
C6Sugar	3136.9709	4414.9217	0	4414.9217	441.4922	3973.4293	0	0	441.4922	441.4922	441.4922	0	0	4414.9213	132.4476
C5Solid	222.7605	222.7605	0	222.7605	22.276	200.4844	0	0	22.276	22.276	22.276	0	0	222.7605	6.6828
C6Solid	56.697	56.697	0	56.697	5.6697	51.0273	0	0	5.6697	5.6697	5.6697	0	0	56.697	1.7009
CaH2O2	2.5725	2.5725	0	2.5725	0.2573	2.3153	0	0	0.2573	0.2573	0.2573	0	0	2.5725	0.0772
Ash	3391.0043	3391.0043	0	3391.0043	339.1004	3051.9039	0	0	339.1004	339.1004	339.1004	0	0	3391.0043	101.7301
Ethanol	36.7448	36.7448	0	36.7448	3.6745	33.0703	0	0	3.6745	1633.8554	1592.0399	0	0	1625.1102	48.7533
Water	268217.56	265853.465	4879.4477	265853.465	26585.3447	239268.104	0	848	27433.3445	27452.8295	27400.2234	0	852.23	267520.53	8025.6162
Furfural	449.7974	449.7974	0	449.7974	44.9797	404.8176	0	0	44.9797	44.9797	44.4698	0	0	449.2874	13.4786
Sulfuric Acid	115.1391	115.1391	0	115.1391	11.5139	103.6252	0	0	11.5139	11.5139	11.5139	0	0	115.1391	3.4542
Nitrogen	1.8527	1.8527	0	1.8527	0.1853	1.6675	0	0	0.1853	0.1853	0.0001	0	0	1.6675	0.05
Carbon Dioxide	4.6827	4.6827	0	4.6827	0.4683	4.2144	0	0	0.4683	1557.7903	23.5018	0	0	27.7161	0.8315
Oxygen	1.0914	1.0914	0	1.0914	0.1091	0.9822	0	0	0.1091	7.5285	0.0055	0	0	0.9877	0.0296
Ammonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lactic Acid	740.8992	740.8992	0	740.8992	74.0899	666.8093	0	0	74.0899	129.8801	129.88	0	0	796.6893	23.9007
Acetic Acid	3588.55	3588.55	0	3588.55	358.855	3229.6948	0	0	358.855	426.2911	426.019	0	0	3655.7142	109.6714
Methane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen Dioxide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sulfur Dioxide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DAP	0	0	0	0	0	0	106	0	106	104.1629	104.1629	106.23	0	210.3929	6.3118

Stream No.	336	337	338	501	502	506	508	510	511	512	515	516	517	518	519
Stream Name															
Temp C	40.9352	41	51.697	95	41	100	99.0442	113.2729	91.7119	116	37.1918	120.4596	35	116.7672	91.7
Pres bar	1.0132	1.0132	1.0132	4.053	1.0132	4.8231	1.8892	1.9384	1.6779	1.6779	4.053	4.3468	1.6779	2.1305	1.4591
Enth MW	-1261.2	-39.192	-1261.2	-1368.4	-1260.6	-1366.5	-3.5616	-134.34	-40.942	-40.644	-32.075	-125.44	-16.751	-1199.7	-26.878
Vapor mass fraction	0	0	0.059362	0.00040053	0	0.00039771	1	1	0.99992	1	0	0	0	0	1
Total kg/h	331047.191	10238.5711	331047.304	353760	323630	353760	1660.1368	48616.7744	25831.903	25831.903	19091.7542	29525.0963	6740.1483	303483	19091.7542
Flowrates in kg/h															
Glucose	21328.9533	0	63.9846	63.9846	63.9846	63.9846	0	0	0	0	0	0	0	63.9846	0
Cellulose	815.285	25.215	815.285	840.5	840.5	840.5	0	0	0	0	0	0	0	840.5	0
Xylose	12475.2023	0	748.5122	748.5122	748.5122	748.5122	0	0	0	0	0	0	0	748.5122	0
Xylan	330.5132	10.2221	330.5132	340.7353	340.7353	340.7353	0	0	0	0	0	0	0	340.7353	0
Lignin	10754.0151	332.5984	10754.0151	11086.6135	11086.6135	11086.6135	0	0	0	0	0	0	0	11086.6135	0
Acetate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Organism	643.763	19.9102	1135.5483	1155.4586	1155.4586	1155.4586	0	0	0	0	0	0	0	1155.4586	0
Solslds	7335.4422	226.8693	7335.4422	7562.3115	7562.3115	7562.3115	0	0	0	0	0	0	0	7562.3115	0
Gypsum	20.4808	0.6334	20.4808	21.1142	21.1142	21.1142	0	0	0	0	0	0	0	21.1142	0
Lgnsol	731.2246	22.6152	731.2246	753.8397	753.8397	753.8397	0	0	0	0	0	0	0	753.8397	0
HMF	120.3766	3.723	120.3766	124.0996	124.0995	124.0996	0	0.0888	0	0	0	0.0888	0	124.0108	0
C5Sugar	2475.4338	50.5295	1068.9459	1119.4754	1119.4754	1119.4754	0	0	0	0	0	0	0	1119.4754	0
C6Sugar	4282.4736	75.4951	2890.6695	2966.165	2966.165	2966.165	0	0	0	0	0	0	0	2966.165	0
C5Solid	216.0777	6.6828	216.0777	222.7605	222.7605	222.7605	0	0	0	0	0	0	0	222.7605	0
C6Solid	54.9961	1.7009	54.9961	56.697	56.697	56.697	0	0	0	0	0	0	0	56.697	0
CaH2O2	2.4954	0.0772	2.4954	2.5726	2.5726	2.5726	0	0	0	0	0	0	0	2.5726	0
Ash	3289.2742	101.7301	3289.2742	3391.0043	3391.0043	3391.0043	0	0	0	0	0	0	0	3391.0043	0
Ethanol	1576.357	48.7533	19086.9508	20125.6153	18610.4821	20125.6153	976.4801	18997.3946	23698.6457	23698.6457	18982.6157	14.7626	4716.0304	151.743	18982.6157
Water	259495	8025.6162	259579	295624.461	267039.155	295624.461	431.215	29201.9543	2132.0895	2132.0895	107.9716	29094.0773	2024.1179	265991.385	107.9716
Furfural	435.8088	13.4786	435.8088	455.2627	443.8883	455.2627	5.4887	236.1783	0.0591	0.0591	0.0591	236.1192	0	213.5969	0.0591
Sulfuric Acid	111.6849	3.4542	111.6849	115.139	115.139	115.139	0	0	0	0	0	0	0	115.139	0
Nitrogen	1.6175	0.05	1.6175	0.0006	0.0006	0.0006	0.0006	0	0	0	0	0	0	0	0
Carbon Dioxide	26.8847	0.8315	16754.8623	247.2211	233.0453	247.2211	246.1115	1.1096	1.1096	1.1096	1.1096	0	0	0	1.1096
Oxygen	0.9581	0.0296	32.9088	0.024	0.0222	0.024	0.0239	0	0	0	0	0	0	0	0
Ammonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lactic Acid	772.7886	1152.3726	1117.6733	2270.0462	2270.0444	2270.0462	0.0001	1.3676	0	0	0	1.3676	0	2268.6792	0
Acetic Acid	3546.043	109.6714	4152.9097	4263.6704	4259.6412	4263.6704	0.8169	178.6808	0	0	0	178.6808	0	4084.1732	0
Methane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen Dioxide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sulfur Dioxide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DAP	204.0811	6.3118	196.1697	202.4815	202.4815	202.4815	0	0	0	0	0	0	0	202.4815	0

Stream No.	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536
Stream Name			Well Water											EVAP COND	
Temp C	116	49.2528	26	87.0895	87.0895	86.487	71.0548	71.0548	71.2455	63.3463	63.3463	62.5145	74.1511	74.1511	40
Pres bar	1.6779	1.0132	1.0132	0.6181	0.6181	0.6181	0.3192	0.3192	0.3293	0.2232	0.2232	0.2232	2.0265	2.0265	3.2424
Enth MW	-26.666	-51.385	-123.36	-916.78	-249.61	-292.67	-525.99	-208.99	-245.49	-275.26	-214.23	-251.91	-790.07	-69.605	-119.57
Vapor mass fraction	1	0.99936	0	2.90E-06	1	7.02E-06	0	1	1.15E-05	0	1	4.69E-05	0	0	0
Total kg/h	19091.7542	20953.3948	28011.3594	235470.714	68012.2636	68012.2636	137879.196	56740.7874	56740.7874	79735.2309	58144	58144	182897.019	16113.0238	33192.2135
Flowrates in kg/h															
Glucose	0	0	0	63.9846	0	0	56.8544	0	0	56.8544	0	0	0	0	4.8928
Cellulose	0	0	0	840.5	0	0	16.1736	0	0	16.1736	0	0	0	0	823.69
Xylose	0	0	0	748.5121	0	0	648.1553	0	0	648.1553	0	0	0	0	74.8512
Xylan	0	0	0	340.7353	0	0	6.5567	0	0	6.5567	0	0	0	0	333.9206
Lignin	0	0	0	11086.6135	0	0	213.3372	0	0	213.3372	0	0	0	0	10864.8812
Acetate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Organism	0	0	0	1155.4586	0	0	555.8557	0	0	555.8557	0	0	0	0	577.7293
Solslds	0	0	0	7562.3115	0	0	6719.6051	0	0	6719.6051	0	0	0	0	578.2827
Gypsum	0	0	0	21.1142	0	0	0.4063	0	0	0.4063	0	0	0	0	20.6919
Lgnsol	0	0	0	753.8397	0	0	669.8356	0	0	669.8356	0	0	0	0	57.6454
HMF	0	0.0001	0	123.844	0.1668	0.1668	109.942	0.1014	0.1014	109.8329	0.1091	0.1091	0.3774	0.0332	9.4702
C5Sugar	0	0	0	1119.4754	0	0	994.7266	0	0	994.7265	0	0	0	0	85.6052
C6Sugar	0	0	0	2966.165	0	0	2568.4759	0	0	2568.4759	0	0	0	0	296.6165
C5Solid	0	0	0	222.7605	0	0	4.2865	0	0	4.2865	0	0	0	0	218.3053
C6Solid	0	0	0	56.697	0	0	1.091	0	0	1.091	0	0	0	0	55.563
CaH2O2	0	0	0	2.5726	0	0	0	0	0	0	0	0	0	0	2.5726
Ash	0	0	0	3391.0043	0	0	65.2523	0	0	65.2523	0	0	0	0	3323.1843
Ethanol	18982.6157	1543.4823	0	31.1905	120.5525	120.5525	4.0738	23.641	23.641	0.3324	3.7414	3.7414	147.9348	13.0329	2.3851
Water	107.9716	1049.1178	28011.3594	198777.387	67214.019	67214.019	120473.609	56153.0132	56153.0132	63064.5348	57409.0707	57409.0707	180776.106	15926.1721	15200.3162
Furfural	0.0591	11.3977	0	70.2409	143.356	143.356	16.5697	45.8439	45.8439	3.1367	13.433	13.433	202.6329	17.8517	5.3713
Sulfuric Acid	0	0	0	115.139	0	0	102.3085	0	0	102.3085	0	0	0	0	8.8046
Nitrogen	0	1.8528	0	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Dioxide	1.1096	18303.0492	0	0	0	0	0	0	0	0	0	0	0	0	0
Oxygen	0	40.4633	0	0	0	0	0	0	0	0	0	0	0	0	0
Ammonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lactic Acid	0	0.0018	0	2266.4819	2.1972	2.1972	2012.4651	1.4511	1.4511	2010.4273	2.0378	2.0378	5.6861	0.5009	173.3158
Acetic Acid	0	4.0289	0	3552.2003	531.9725	531.9725	2639.6188	516.7417	516.7417	1924.0465	715.5725	715.5725	1764.2867	155.4317	271.6333
Methane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen Dioxide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sulfur Dioxide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DAP	0	0	0	202.4815	0	0	0	0	0	0	0	0	0	0	202.4815

Stream No.	550	551	552	557	558	559	560	571	572	573	574	575	576	579	580
Stream Name	Vent			Air			From A500	WET SOLIDS			A900 Water	EVAP BTMS		To 800	
Temp C	34.171	50.4061	41.8714	25	404.576	40	40	40	40	40	20	63.4809	41.9386	40	40
Pres bar	0.9119	0.9119	4.053	1.0132	9.6317	9.6317	1.0132	1.0132	3.2424	3.2424	1.0132	3.2424	1.0132	1.0132	3.2424
Enth MW	-47.109	-127.64	-1388.2	1.19E-08	0.48461	-0.0020127	-0.8183	-118.59	-808.66	-30.617	-462.22	-275.25	-618.28	-0.8183	-778.05
Vapor mass fraction	1	0	0	1	1	1	1	0	0	0	0	0	0	1	0
Total kg/h	18834.7073	30130.0504	353760	4618.3987	4618.3987	4618.3987	4844.8852	32965.7291	202278.497	7658.512	104788.002	79735.2309	141971.605	4844.8852	194620
Flowrates in kg/h															
Glucose	0	0	63.9846	0	0	0	0	4.8928	59.0917	2.2373	0	56.8544	2.2373	0	56.8544
Cellulose	0	0	840.5	0	0	0	0	823.69	16.81	0.6364	0	16.1736	0.6364	0	16.1736
Xylose	0	0	748.5122	0	0	0	0	74.8512	673.6609	25.5056	0	648.1553	25.5056	0	648.1553
Xylan	0	0	340.7353	0	0	0	0	333.9206	6.8147	0.258	0	6.5567	0.258	0	6.5567
Lignin	0	0	11086.6135	0	0	0	0	10864.8812	221.7323	8.3951	0	213.3372	8.3951	0	213.3372
Acetate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Organism	0	0	1155.4586	0	0	0	0	577.7293	577.7293	21.8735	0	555.8557	21.8735	0	555.8557
Solslds	0	0	7562.3115	0	0	0	0	578.2827	6984.0291	264.4239	0	6719.6051	264.4239	0	6719.6051
Gypsum	0	0	21.1142	0	0	0	0	20.6919	0.4223	0.016	0	0.4063	0.016	0	0.4063
Lgnsol	0	0	753.8397	0	0	0	0	57.6454	696.1944	26.3588	0	669.8356	26.3588	0	669.8356
HMF	0	0.0001	124.0996	0	0	0	0.0001	9.4702	114.3738	4.3303	0	109.8329	4.4191	0.0001	110.0434
C5Sugar	0	0	1119.4754	0	0	0	0	85.6052	1033.8702	39.1436	0	994.7265	39.1436	0	994.7266
C6Sugar	0	0	2966.165	0	0	0	0	296.6165	2669.5483	101.0724	0	2568.4759	101.0724	0	2568.4759
C5Solid	0	0	222.7605	0	0	0	0	218.3053	4.4552	0.1687	0	4.2865	0.1687	0	4.2865
C6Solid	0	0	56.697	0	0	0	0	55.563	1.1339	0.0429	0	1.091	0.0429	0	1.091
CaH2O2	0	0	2.5726	0	0	0	0	2.5726	0	0	0	0	0	0	0
Ash	0	0	3391.0043	0	0	0	0	3323.1843	67.8201	2.5678	0	65.2523	2.5678	0	65.2523
Ethanol	28.3489	1515.1336	20125.6153	0	0	0	0.4593	1.9258	28.8054	1.0906	0	0.3324	15.8532	0.4593	27.7148
Water	475.1486	28585.3309	295624.461	0	0	0	224.1718	14976.1441	183577.068	6950.453	104788.002	63064.5348	140832.536	224.1718	176626.615
Furfural	0.0233	11.3744	455.2627	0	0	0	0.5638	4.8074	64.8697	2.456	0	3.1367	238.5753	0.5638	62.4136
Sulfuric Acid	0	0	115.139	0	0	0	0	8.8046	106.3345	4.026	0	102.3085	4.026	0	102.3085
Nitrogen	1.8527	0	0.0006	3648.5353	3648.5353	3648.5353	3648.3834	0.1521	0	0	0	0	0	3648.3834	0
Carbon Dioxide	18288.8727	14.1758	247.2211	0	0	0	0	0	0	0	0	0	0	0	0
Oxygen	40.4615	0.0018	0.024	969.8633	969.8633	969.8633	969.7831	0.0802	0	0	0	0	0	969.7831	0
Ammonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lactic Acid	0	0.0018	2270.0462	0	0	0	0.0009	173.3149	2093.1662	79.2498	0	2010.4273	80.6174	0.0009	2013.9162
Acetic Acid	0	4.0289	4263.6704	0	0	0	1.5228	270.1105	3280.5669	124.2063	0	1924.0465	302.8871	1.5228	3156.3608
Methane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen Dioxide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sulfur Dioxide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DAP	0	0	202.4815	0	0	0	0	202.4815	0	0	0	0	0	0	0

Stream No.	596	597	612	614	615	617	618	619	620	621	623	624	625	626
Stream Name	LP STM		To Anaerobic		From A600					To 600				
Temp C	163.26	147.741	81.1983	81.536	81.6342	81.536	81.5361	52.8112	21	35.0121	0	21	21	20
Pres bar	4.4786	4.4786	2.0265	2.0265	2.0265	2.0265	2.0265	1.0132	0.9818	1	0	0.9818	0.9818	1.0132
Enth MW	-1.8203	-2.1182	-309.07	-3.5383	-3.5433	-305.53	-305.53	-305.57	-1.3884	-173.22	0	-308.92	0	-0.043101
Vapor mass fraction	1	0.0003125	0	1	1	0	0	0.33471	1	0	0	0	0	1
Total kg/h	497.0711	497.0711	71889.3232	1476.6225	1478.0052	70412.7028	70412.7028	101106.802	31055.3256	39993.296	0	70051.4874	0	30694.0996
Flowrates in kg/h														
Glucose	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cellulose	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Xylose	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Xylan	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lignin	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acetate	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Organism	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Solslds	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gypsum	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lgnsol	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HMF	0	0	0.1942	0	0	0	0	0	0	0.1609	0	0	0	0
C5Sugar	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C6Sugar	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C5Solid	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C6Solid	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CaH2O2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ash	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ethanol	0	0	71.1546	0.062	0.0623	1.3611	1.3611	1.3611	0.0127	58.1217	0	0.0009	0	0
Water	497.0711	497.0711	70855.7421	252.1075	253.4381	70399.336	70399.336	70399.336	351.4123	39146.5666	0	70051.4378	0	0
Furfural	0	0	363.0621	0	0	0	0	0	0	345.2103	0	0	0	0
Sulfuric Acid	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen	0	0	0.0016	0.0016	0.0016	0	0	23545	23545	0.0016	0	0.0039	0	23545
Carbon Dioxide	0	0	0.0004	877.1952	877.2455	10.7803	10.7803	10.7803	16.0637	0.0004	0	0.0033	0	0
Oxygen	0	0	0.0009	0.0009	0.0009	0	0	7149.1088	7142.8502	0.0009	0	0.0382	0	7149.1092
Ammonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lactic Acid	0	0	0.5038	0	0	0.5038	0.5038	0.5038	0	0.0029	0	0.005	0	0
Acetic Acid	0	0	598.6655	0	0	0	0	0	0	443.2338	0	0	0	0
Methane	0	0	0	347.2553	347.2569	0.7222	0.7222	0.7222	0	0	0	0	0	0

Stream No.	700	701	703	800	804	811	812	813	814	815	821	823	840	842	843
Stream Name		Gasoline	Ethanol	TO BOILER	Air	Well MU Wat	Superheated	BFW	To S216		Blowdown		CORN STOVI	To S215	To S302
Temp C	37.1918	20	36.6272	63.4809	24	26	510	139	267.9948	163.339	299.7772	189.943	20	163.339	163.339
Pres bar	4.053	1.0132	1.0132	3.2424	1.0132	1.7225	87.2003	99.6126	13.1722	4.4786	87.7474	12.4832	1.0132	4.4786	4.4786
Enth MW	-32.075	-0.49893	-32.574	-275.25	-0.057737	-98.858	-433.4	-547.21	-104.95	-312.18	-15.614	-36.658	-47.059	-3.67E-07	-3.67E-07
Vapor mass fraction	0	0	0	0	1	0	1	0	1	1	0	1	0	1	1
Total kg/h	19091.7542	788.1077	19879.8621	79735.2309	205000	22447	124160	128000	29042.5024	85117.4729	3840.0311	10000.001	22000	0.0001	0.0001
Flowrates in kg/h															
Glucose	0	0	0	56.8544	0	0	0	0	0	0	0	0	0	0	0
Cellulose	0	0	0	16.1736	0	0	0	0	0	0	0	0	6999.0446	0	0
Xylose	0	0	0	648.1553	0	0	0	0	0	0	0	0	0	0	0
Xylan	0	0	0	6.5567	0	0	0	0	0	0	0	0	3942.4986	0	0
Lignin	0	0	0	213.3372	0	0	0	0	0	0	0	0	3366.629	0	0
Acetate	0	0	0	0	0	0	0	0	0	0	0	0	548.6106	0	0
Organism	0	0	0	555.8557	0	0	0	0	0	0	0	0	0	0	0
Solslds	0	0	0	6719.6051	0	0	0	0	0	0	0	0	1664.147	0	0
Gypsum	0	0	0	0.4063	0	0	0	0	0	0	0	0	0	0	0
Lgnsol	0	0	0	669.8356	0	0	0	0	0	0	0	0	0	0	0
HMF	0	0	0	109.8329	0	0	0	0	0	0	0	0	0	0	0
C5Sugar	0	0	0	994.7265	0	0	0	0	0	0	0	0	0	0	0
C6Sugar	0	0	0	2568.4759	0	0	0	0	0	0	0	0	0	0	0
C5Solid	0	0	0	4.2865	0	0	0	0	0	0	0	0	546.9069	0	0
C6Solid	0	0	0	1.091	0	0	0	0	0	0	0	0	654.2438	0	0
CaH2O2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ash	0	0	0	65.2523	0	0	0	0	0	0	0	0	977.9574	0	0
Ethanol	18982.6157	0	18982.6157	0.3324	0	0	0	0	0	0	0	0	0	0	0
Water	107.9716	0	107.9716	63064.5348	0	22447	124160	128000	29042.5024	85117.4729	3840.0311	10000.001	3299.9472	0.0001	0.0001
Furfural	0.0591	0	0.0591	3.1367	0	0	0	0	0	0	0	0	0	0	0
Sulfuric Acid	0	0	0	102.3085	0	0	0	0	0	0	0	0	0	0	0
Nitrogen	0	0	0	0	161950	0	0	0	0	0	0	0	0	0	0
Carbon Dioxide	1.1096	0	1.1096	0	0	0	0	0	0	0	0	0	0	0	0
Oxygen	0	0	0	0	43050.0018	0	0	0	0	0	0	0	0	0	0
Ammonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lactic Acid	0	0	0	2010.4273	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	1924.0465	0	0	0	0	0	0	0	0	0	0	0
Methane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen Dioxide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sulfur Dioxide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DAP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2-2-4-TriMth-C5	0	788.1077	788.1077	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	844	845	846	848	849	850	851	852	854	855	856	861	862	863	864
Stream Name	To Mol Sve	To D501	To D502		to Dearatr			To Evaprator				Evap Cond			Cond 501&50
Temp C	163.339	163.339	163.339	163.339	163.339	117.9874	117.9874	117.9874	50.7428	50.7428	50.7581	115.21	30.2857	117.6356	147.74
Pres bar	4.4786	4.4786	4.4786	4.4786	4.4786	1.7225	1.7225	1.7225	0.1013	0.1013	4.2556	1.7023	3.445	1.7023	4.4786
Enth MW	-1.8228	-198.65	-24.25	-87.452	-3.67E-08	-93.788	-78.884	-14.903	-79.884	-79.884	-87.847	-16.312	-98.856	-418.86	-259.3
Vapor mass fraction	1	1	1	1	1	0.60031	0.60031	0.60031	0.60031	0.60031	0	0	0	0.60031	0
Total kg/h	497	54164.0071	6612	23844.4667	0	23844.4667	20055.4662	3789.0001	20055.4679	20055.4679	20055.4679	3789.0001	22447	106484.012	60776
Flowrates in kg/h															
Water	497	54164.0071	6612	23844.4667	0	23844.4667	20055.4662	3789.0001	20055.4679	20055.4679	20055.4679	3789.0001	22447	106484.012	60776

Stream No.	865	869	871	872	873	921	922	923	924	925	926	931	932	944	950
Stream Name	Cond E302	To WWT	VENT		BFW	CWS		CWS		CWS		CWS		CT BLOWDOWN	
Temp C	147.74	120.6474	137	137	138.5518	28	37	28	37	28	37	28	37	28	44.4833
Pres bar	4.4786	2.0265	3.3437	3.3437	99.6126	4.1341	4.1341	4.1341	4.1341	4.1341	4.1341	4.1341	4.1341	1.0132	0.9818
Enth MW	-38.291	-10.227	0	-671.03	-547.28	-2215	-2207.3	0	0	-50.393	-50.273	0	0	-49.572	-549.71
Vapor mass fraction	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Total kg/h	8975.0001	2379.2136	0	156810	128000	502646.004	502646.004	0	0	11448.3755	11448.3755	0	0	11262.0004	125794.489
Flowrates in kg/h															
Water	8975.0001	2379.2136	0	156810	128000	502646.004	502646.004	0	0	11448.3755	11448.3755	0	0	11262.0004	125148.02
Furfural	0	0	0	0	0	0	0	0	0	0	0	0	0	0	61.7581
Sulfuric Acid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0039
Carbon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0033
Oxygen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0382
Ammonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lactic Acid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.738
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	537.7159

Stream No.	955	956	957	958	1003	1103	1105	1110	1111	1113	1114	1115	1116	1120	1121
Stream Name	CWS		CWS												
Temp C	28	37	28	37	40	241.1346	48.8889	563.4046	499.2643	499.2643	499.2643	499.2643	587	15.5555	68.5937
Pres bar	4.1341	4.1341	4.1341	4.1341	1.0132	1.5648	1.5648	1.5648	1.5648	1.5648	1.5648	1.5648	1.5648	1.0342	1.5648
Enth MW	-2190	-2184.8	-15872	-15834	-0.8183	-116.5	-59.05	-1184.2	-1184.2	-1161.3	-9.7811	-1151.5	-1124.6	-0.29371	1.3027
Vapor mass fraction	0	0	0	0	1	1	0	0.72911	0.77193	0	0	0	0	1	1
Total kg/h	497538.44	497538.44	3605820.07	3605820.07	4844.8852	129827.222	19281.2176	920480	920480	909549	9548.9486	900000	900000	110000	110000
Flowrates in kg/h															
Glucose	0	0	0	0	0	0	4.8928	4.8928	0.0001	0.0001	0.0001	0	0	0	0
Cellulose	0	0	0	0	0	0	823.69	823.69	0.0022	0.0022	0.0022	0	0	0	0
Xylose	0	0	0	0	0	0	74.8512	74.8513	0.0002	0.0002	0.0002	0	0	0	0
Xylan	0	0	0	0	0	0	333.9206	333.9206	0.0008	0.0008	0.0008	0	0	0	0
Lignin	0	0	0	0	0	0	10864.8812	10864.8812	0.0275	0.0275	0.0275	0	0	0	0
Acetate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Organism	0	0	0	0	0	0	577.7293	577.7293	0.0014	0.0014	0.0014	0	0	0	0
Solslds	0	0	0	0	0	0.0004	578.2827	578.2827	0.0016	0.0016	0.0016	0	0	0	0
Gypsum	0	0	0	0	0	0	20.6919	20.6919	20.6919	20.6919	20.6919	0	0	0	0
Lgnsol	0	0	0	0	0	0	57.6454	57.6454	0.0002	0.0002	0.0002	0	0	0	0
HMF	0	0	0	0	0.0001	0	9.4702	9.4702	0	0	0	0	0	0	0
C5Sugar	0	0	0	0	0	0	85.6052	85.6053	0.0003	0.0003	0.0003	0	0	0	0
C6Sugar	0	0	0	0	0	0	296.6165	296.6165	0.0008	0.0008	0.0008	0	0	0	0
C5Solid	0	0	0	0	0	0	218.3053	218.3053	0.0005	0.0005	0.0005	0	0	0	0
C6Solid	0	0	0	0	0	0	55.563	55.563	0.0001	0.0001	0.0001	0	0	0	0
CaH2O2	0	0	0	0	0	0	2.5726	2.5726	2.5726	2.5726	2.5726	0	0	0	0
Ash	0	0	0	0	0	0	3323.1843	3323.1843	3323.1843	3323.1843	3323.1843	0	0	0	0
Ethanol	0	0	0	0	0.4593	1.7278	0.1981	0.1981	0.1981	0	0	0	0	0	0
Water	497538.44	497538.44	3605820.07	3605820.07	224.1718	18199.5168	1540.2177	1540.2177	2434.2451	0	0	0	0	0	0
Furfural	0	0	0	0	0.5638	4.313	0.4944	0.4944	0.4944	0	0	0	0	0	0
Sulfuric Acid	0	0	0	0	0	0	8.8046	8.8046	8.8046	0	0	0	0	0	0
Nitrogen	0	0	0	0	3648.3834	84475.2995	0.0156	95.9293	191.8275	0	0	0	0	84379.386	84379.386
Carbon Dioxide	0	0	0	0	0	22960.5251	0	0	1299.9962	0	0	0	0	0	0
Oxygen	0	0	0	0	969.7831	3906.8611	0.0082	0.0165	0.0165	0	0	0	0	25620.614	25620.614
Ammonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lactic Acid	0	0	0	0	0.0009	0	173.3149	173.3149	173.3149	0	0	0	0	0	0
Acetic Acid	0	0	0	0	1.5228	242.3311	27.7795	27.7795	377.3149	0	0	0	0	0	0
Methane	0	0	0	0	0	0.0001	0	199.9984	399.9978	0	0	0	0	0	0
Nitrogen Dioxide	0	0	0	0	0	0.4508	0	0	0	0	0	0	0	0	0
Sulfur Dioxide	0	0	0	0	0	7.6998	0	0	0	0	0	0	0	0	0
DAP	0	0	0	0	0	0	202.4815	202.4815	202.4815	202.4815	202.4815	0	0	0	0
2-2-4-TriMth-C5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0.2433	0	602.1655	1204.333	0	0	0	0	0	0
Carbon	0	0	0	0	0	0	0	0	5999.983	5999.983	5999.983	0	0	0	0
Carbon Monoxide	0	0	0	0	0	28.2569	0	299.9981	599.9972	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	199.9994	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HydroxyAcetone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Formaldehyde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2-5-Xylenol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sulphur	0	0	0	0	0	0	0	0	0.5245	0	0	0	0	0	0
Hydroxyacetalde	0	0	0	0	0	0	0	0	1006.6621	0	0	0	0	0	0
Pyrolignin	0	0	0	0	0	0	0	0	2516.6585	0	0	0	0	0	0
Levoglucosan	0	0	0	0	0	0	0	0	223.7027	0	0	0	0	0	0
Toluene	0	0	0	0	0	0	0	0	292.2676	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	900000	900000	900000	0	900000	900000	0	0

Stream No.	1123	1124	1126	1127	1130	1131	1132	1133	1134	1135	1137	1138	1139	1140	1144
Stream Name															
Temp C	105.3141	1596.2098	963.8307	530	499.2643	68	68.0491	68.0491	68.0491	65.5555	65.5555	45	65.5555	68	68
Pres bar	1.5648	1.5648	1.5648	1.5648	1.5648	1.5648	2.7369	2.7369	2.7369	2.7369	2.7369	2.3922	2.7369	1.5648	1.5648
Enth MW	-9.0077	3.9088	-39.804	-56.964	-22.917	-566.35	4.54E-06	-566.11	-566.11	-566.31	-549.32	-550.86	-16.989	-10.346	-10.203
Vapor mass fraction	1	0	1	1	0.77193	0	0	0	0	0	0	0	0	1	0.55095
Total kg/h	120747.026	4604.2961	116142.716	116142.716	10930.3544	165107.24	0.5245	165039.655	165039.13	165039.13	160088	160088	4951.1738	5911.0784	3514.9112
Flowrates in kg/h															
Glucose	0.0001	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cellulose	0.0022	0.0004	0	0	0	0	0	0	0	0	0	0	0	0	0
Xylose	0.0002	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Xylan	0.0008	0.0003	0	0	0	0	0	0	0	0	0	0	0	0	0
Lignin	0.0275	0.0001	0	0	0	0	0	0	0	0	0	0	0	0	0
Acetate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Organism	0.0014	0.0001	0	0	0	0	0	0	0	0	0	0	0	0	0
Solslds	0.0016	0	0.0004	0.0004	0	0	0	0	0	0	0	0	0	0	0
Gypsum	20.6919	0.0007	0	0	0	0	0	0	0	0	0	0	0	0	0
Lgnsol	0.0002	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HMF	0	0	0	0	0	5.4077	0	5.575	5.575	5.575	5.4077	5.4077	0.1672	0	0
C5Sugar	0.0003	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C6Sugar	0.0008	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C5Solid	0.0005	0.0005	0	0	0	0	0	0	0	0	0	0	0	0	0
C6Solid	0.0001	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CaH2O2	2.5726	4400.2646	0	0	0	0	0	0	0	0	0	0	0	0	0
Ash	3323.1843	1.5477	0	0	0	0	0	0	0	0	0	0	0	0	0
Ethanol	0	0	0	0	0.1981	0.7751	0	0.7748	0.7748	0.7748	0.7516	0.7516	0.0232	0.1745	0.1745
Water	0	0	4763.5916	4763.5916	2434.2451	31221.3936	0	31216.7478	31216.7478	31216.7478	30280.2497	30280.2497	936.5025	1493.0971	1493.0971
Furfural	0	0	0	0	0.4944	10.2535	0	10.2486	10.2486	10.2486	9.9411	9.9411	0.3075	0.182	0.182
Sulfuric Acid	0	0	0	0	8.8046	293.4858	0	293.4859	293.4859	293.4859	284.6813	284.6813	8.8046	0	0
Nitrogen	84475.2995	0	84475.1648	84475.1648	191.8275	0.0075	0	0.0075	0.0075	0.0075	0.0072	0.0072	0.0002	191.8273	0
Carbon Dioxide	0	0	22960.5251	22960.5251	1299.9962	1.089	0	1.0887	1.0887	1.0887	1.0561	1.0561	0.0327	1299.9632	1299.9632
Oxygen	25620.6228	0	3906.7875	3906.7875	0.0165	0	0	0	0	0	0	0	0	0.0165	0
Ammonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lactic Acid	0	0	0	0	173.3149	5765.2605	0	5765.2733	5765.2733	5765.2733	5592.3155	5592.3155	172.9582	0.369	0.369
Acetic Acid	0	0	0	0	377.3149	8194.0744	0	8190.1622	8190.1622	8190.1622	7944.4577	7944.4577	245.7049	127.6979	127.6979
Methane	199.9983	0	0.0001	0.0001	399.9978	0.0376	0	0.0376	0.0376	0.0376	0.0364	0.0364	0.0011	399.9966	0
Nitrogen Dioxide	0	0	0.4508	0.4508	0	0	0	0	0	0	0	0	0	0	0
Sulfur Dioxide	0	0	7.6998	7.6998	0	0	0	0	0	0	0	0	0	0	0
DAP	202.4815	202.4815	0	0	0	0	0	0	0	0	0	0	0	0	0
2-2-4-TriMth-C5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	602.1654	0	0.2433	0.2433	1204.333	0.0731	0	0.0731	0.0731	0.0731	0.0709	0.0709	0.0022	1204.3308	0
Carbon	5999.983	0.0001	0	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Monoxide	299.9981	0	28.2569	28.2569	599.9972	0.0343	0	0.0343	0.0343	0.0343	0.0333	0.0333	0.001	599.9962	0
Ethane	0	0	0	0	199.9994	0.0171	0	0.0171	0.0171	0.0171	0.0166	0.0166	0.0005	199.9989	199.9989
Propane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HydroxyAcetone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Formaldehyde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2-5-Xylenol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sulphur	0	0	0	0	0.5245	0.5245	0.5245	0.5245	0	0	0	0	0	0	0
Hydroxyacetalde	0	0	0	0	1006.6621	29589.168	0	29578.3208	29578.3208	29578.3208	28691	28691	887.3496	108.4655	108.4655
Pyrolignin	0	0	0	0	2516.6585	82451.3562	0	82406.9041	82406.9041	82406.9041	79934.6981	79934.6981	2472.2073	0	0
Levoglucosan	0	0	0	0	223.7027	7171.6759	0	7168.0897	7168.0897	7168.0897	6953.0475	6953.0475	215.0427	5.0733	5.0733
Toluene	0	0	0	0	292.2676	402.5874	0	402.2781	402.2781	402.2781	390.2097	390.2097	12.0683	279.89	279.89
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	1145	1146	1147	1148	1150	1160	1161	1800	1801	1911	1912	1913	1921	1922	1923
Stream Name					Pyro Oil			CWS	CWR	LP STM			VLP STEAM		
Temp C	68	68	68	68	70.5453	15.5555	1371.0712	35	40.5555	164	147.574	147.574	115.0288	115.0277	164
Pres bar	1.5648	1.5648	1.5648	1.5648	1.5648	1.2201	1.2201	4.4606	4.1159	4.4583	4.4583	4.4583	1.6921	1.6921	4.4583
Enth MW	-1.0586	-1.0586	-0.52929	-0.52929	-27.193	-24.561	-20.652	-1051.6	-1050.1	-198.33	-230.83	-230.83	-198.71	-232.06	-24.21
Vapor mass fraction	1	1	1	1	0.22087	0	1	0	0	1	0	0	1	0	1
Total kg/h	2396.1675	2396.1675	1198.0837	1198.0837	8466.0881	5561.496	10165.7917	239351.112	239351.112	54165.173	54165.173	54165.173	53963.7744	53963.7744	6611.818
Flowrates in kg/h															
Glucose	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cellulose	0	0	0	0	0	0	0.0004	0	0	0	0	0	0	0	0
Xylose	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Xylan	0	0	0	0	0	0	0.0003	0	0	0	0	0	0	0	0
Lignin	0	0	0	0	0	0	0.0001	0	0	0	0	0	0	0	0
Acetate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Organism	0	0	0	0	0	0	0.0001	0	0	0	0	0	0	0	0
Solslds	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gypsum	0	0	0	0	0	0	0.0007	0	0	0	0	0	0	0	0
Lgnsol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HMF	0	0	0	0	0.1672	0	0	0	0	0	0	0	0	0	0
C5Sugar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C6Sugar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C5Solid	0	0	0	0	0	0	0.0005	0	0	0	0	0	0	0	0
C6Solid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CaH2O2	0	0	0	0	0	0	4400.2646	0	0	0	0	0	0	0	0
Ash	0	0	0	0	0	0	1.5477	0	0	0	0	0	0	0	0
Ethanol	0	0	0	0	0.1977	0	0	0	0	0	0	0	0	0	0
Water	0	0	0	0	2429.6004	5561.496	5561.496	239351.112	239351.112	54165.173	54165.173	54165.173	53963.7744	53963.7744	6611.818
Furfural	0	0	0	0	0.4895	0	0	0	0	0	0	0	0	0	0
Sulfuric Acid	0	0	0	0	8.8046	0	0	0	0	0	0	0	0	0	0
Nitrogen	191.8273	191.8273	95.9136	95.9136	0.0002	0	0	0	0	0	0	0	0	0	0
Carbon Dioxide	0	0	0	0	1299.9966	0	0	0	0	0	0	0	0	0	0
Oxygen	0.0165	0.0165	0.0082	0.0082	0	0	0	0	0	0	0	0	0	0	0
Ammonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lactic Acid	0	0	0	0	173.3273	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	373.4028	0	0	0	0	0	0	0	0	0	0
Methane	399.9966	399.9966	199.9983	199.9983	0.0011	0	0	0	0	0	0	0	0	0	0
Nitrogen Dioxide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sulfur Dioxide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DAP	0	0	0	0	0	0	202.4815	0	0	0	0	0	0	0	0
2-2-4-TriMth-C5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	1204.3308	1204.3308	602.1654	602.1654	0.0022	0	0	0	0	0	0	0	0	0	0
Carbon	0	0	0	0	0	0	0.0001	0	0	0	0	0	0	0	0
Carbon Monoxide	599.9962	599.9962	299.9981	299.9981	0.001	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	199.9995	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HydroxyAcetone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Formaldehyde	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2-5-Xylenol	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydroxyacetalde	0	0	0	0	995.8152	0	0	0	0	0	0	0	0	0	0
Pyrolignin	0	0	0	0	2472.2078	0	0	0	0	0	0	0	0	0	0
Levoglucosan	0	0	0	0	220.1161	0	0	0	0	0	0	0	0	0	0
Toluene	0	0	0	0	291.9584	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	1924	1925	2217	2227	2228	2230	2239	2240	2241	2520	2521	2522	5102	5211	5219
Stream Name								FILTRATE	H-244 Vapor				To S102	To S211	To S219
Temp C	147.574	147.574	197.7722	49.8868	50	52.5328	52.5328	50	35.0121	99.8733	35	35.0121	74.1511	74.1511	41.9386
Pres bar	4.4583	4.4583	39.7802	1	1.0132	1.0132	2.0265	1	1	1.0132	1.0132	1	2.0265	2.0265	1.0132
Enth MW	-28.21	-28.21	-736.32	-924.98	-926.07	-907.13	-927.95	-916.35	-173.22	-164.81	-172.53	-173.22	-144.94	-334.73	-618.28
Vapor mass fraction	0	0	0	1.73E-06	0	1.78E-06	0	1.76E-06	0	0.19512	0	0	0	0	0
Total kg/h	6611.818	6611.818	217282.68	238116	238116	232834	238967.372	235784.061	39993.296	39835.1765	39835.1765	39993.296	33553	77488	141971.605
Flowrates in kg/h															
Glucose	0	0	0	1771.9691	1771.9691	1762.618	1771.9691	1771.9691	0	0	0	0	0	0	2.2373
Cellulose	0	0	24261.5609	111.1394	111.1394	0.5557	111.1394	111.1394	0	0	0	0	0	0	0.6364
Xylose	0	0	0	13169.903	13169.903	13100.4023	13169.903	13169.903	0	0	0	0	0	0	25.5056
Xylan	0	0	13666.3191	1.7114	1.7114	0.0086	1.7114	1.7114	0	0	0	0	0	0	0.258
Lignin	0	0	11670.1175	55.6571	55.6571	0.2783	55.6571	55.6571	0	0	0	0	0	0	8.3951
Acetate	0	0	1901.7093	0	0	0	0	0	0	0	0	0	0	0	0
Organism	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21.8735
Solslds	0	0	5875.4781	6861.7527	6861.7527	6825.5415	6861.7527	6861.7527	0	0	0	0	0	0	264.4239
Gypsum	0	0	0	0	2728.0646	21.1142	4222.8586	0	0	0	0	0	0	0	0.016
Lgnsol	0	0	0	683.8315	683.8315	680.2227	683.8315	683.8315	0	0	0	0	0	0	26.3588
HMF	0	0	0.0201	112.9064	112.9064	112.3106	112.9064	112.9064	0.1609	0.1608	0.1608	0.1609	0.0692	0.1599	4.4191
C5Sugar	0	0	0	2341.334	2341.334	2328.9784	2341.334	2341.334	0	0	0	0	0	0	39.1436
C6Sugar	0	0	0	2865.4715	2865.4715	2850.3496	2865.4715	2865.4719	0	0	0	0	0	0	101.0724
C5Solid	0	0	1895.8035	0	0	0	0	0	0	0	0	0	0	0	0.1687
C6Solid	0	0	2267.8775	0	0	0	0	0	0	0	0	0	0	0	0.0429
CaH2O2	0	0	0	2331.7899	1157.7868	2.5725	514.5127	0	0	0	0	0	0	0	0
Ash	0	0	3390.0019	17.0227	17.0227	0.0851	17.0227	17.0227	0	0	0	0	0	0	2.5678
Ethanol	0	0	73.8375	31.911	31.911	31.7426	31.911	31.911	58.1217	58.0866	58.0866	58.1217	27.1391	62.6756	15.8532
Water	6611.818	6611.818	149408.337	202007.447	202007.447	200941.406	202007.447	202007.447	39146.5666	38990.1268	38990.1268	39146.5666	33163.9136	76589.4331	140832.536
Furfural	0	0	127.5213	392.6971	392.6971	390.6247	392.697	392.6971	345.2103	344.9017	344.9017	345.2103	37.1736	85.8495	238.5753
Sulfuric Acid	0	0	1641.1199	1554.0614	0	0	0	1554.0614	0	0	0	0	0	0	4.026
Nitrogen	0	0	0	1.8626	1.8626	1.8527	1.8626	1.8626	0.0016	0	0	0.0016	0	0	0
Carbon Dioxide	0	0	0	0.3966	0.3966	0.3945	0.3966	0.3966	0.0004	0	0	0.0004	0	0	0
Oxygen	0	0	0	1.0972	1.0972	1.0914	1.0972	1.0972	0.0009	0	0	0.0009	0	0	0
Ammonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lactic Acid	0	0	1.3482	571.7846	571.7846	568.7671	571.7845	571.7846	0.0029	0.0023	0.0023	0.0029	1.0431	2.409	80.6174
Acetic Acid	0	0	1101.6335	3230.1278	3230.1278	3213.0816	3230.1278	3230.1281	443.2338	441.8991	441.8991	443.2338	323.6636	747.4755	302.8871

Stream No.	5251	5511	5518	5519	5520	5521	5523	5525	5571	5618	6110	6111	6112	8001	8002
Stream Name	To T-914										BFW	To Deareator	From U1100		
Temp C	74.1511	122.534	86.9859	116	37	70.9641	70.9722	87.1343	63.4809	120.3871	137	179.8844	179.8844	43.3225	59.4266
Pres bar	2.0265	2.1305	0.6181	1.6779	1.0132	1.5513	1.7225	2.0265	3.2424	2.0272	10	10	10	1.0132	1.0132
Enth MW	-240.8	-1197.8	-1199.7	-13.978	-32.077	-16.538	-16.538	-916.77	-275.25	-125.45	-123.14	-111.95	-105.98	-325.85	-333.71
Vapor mass fraction	0	0	0.053693	1	0	0	0	0	0	2.59E-06	0	0.60031	0.97	0.014868	0.041851
Total kg/h	55743.0011	303483	303483	6740.1483	19091.7542	6740.1483	6740.1483	235470.714	79735.2309	29525.0963	28809.6111	28809.6111	28809.6093	103213.215	103213.215
Flowrates in kg/h															
Glucose	0	63.9846	63.9846	0	0	0	0	63.9846	56.8544	0	0	0	0	56.8544	56.8544
Cellulose	0	840.5	840.5	0	0	0	0	840.5	16.1736	0	0	0	0	7015.2184	7015.2184
Xylose	0	748.5122	748.5121	0	0	0	0	748.5121	648.1553	0	0	0	0	648.1553	648.1553
Xylan	0	340.7353	340.7353	0	0	0	0	340.7353	6.5567	0	0	0	0	3949.0553	3949.0553
Lignin	0	11086.6135	11086.6135	0	0	0	0	11086.6135	213.3372	0	0	0	0	3579.966	3579.966
Acetate	0	0	0	0	0	0	0	0	0	0	0	0	0	548.6106	548.6106
Organism	0	1155.4586	1155.4586	0	0	0	0	1155.4586	555.8557	0	0	0	0	555.8557	555.8557
Solslds	0	7562.3115	7562.3115	0	0	0	0	7562.3115	6719.6051	0	0	0	0	8383.7513	8383.7513
Gypsum	0	21.1142	21.1142	0	0	0	0	21.1142	0.4063	0	0	0	0	0.4063	0.4063
Lgnsol	0	753.8397	753.8397	0	0	0	0	753.8397	669.8356	0	0	0	0	669.8354	669.8354
HMF	0.115	124.0108	124.0108	0	0	0	0	123.844	109.8329	0.0888	0	0	0	109.8329	109.8329
C5Sugar	0	1119.4754	1119.4754	0	0	0	0	1119.4754	994.7265	0	0	0	0	994.7264	994.7264
C6Sugar	0	2966.165	2966.165	0	0	0	0	2966.165	2568.4759	0	0	0	0	2568.4759	2568.4759
C5Solid	0	222.7605	222.7605	0	0	0	0	222.7605	4.2865	0	0	0	0	551.1934	551.1934
C6Solid	0	56.697	56.697	0	0	0	0	56.697	1.091	0	0	0	0	655.3348	655.3348
CaH2O2	0	2.5726	2.5726	0	0	0	0	2.5726	0	0	0	0	0	0	0
Ash	0	3391.0043	3391.0043	0	0	0	0	3391.0043	65.2523	0	0	0	0	1043.2097	1043.2097
Ethanol	45.0873	151.7402	151.743	4716.0304	18982.6157	4716.0304	4716.0304	31.1905	0.3324	14.7626	0	0	0	0.3947	0.3947
Water	55096.5895	265991.385	265991.385	2024.1179	107.9716	2024.1179	2024.1179	198777.387	63064.5348	29094.0773	28809.6111	28809.6111	28809.6093	66617.9136	66617.9136
Furfural	61.7581	213.5954	213.5969	0	0.0591	0	0	70.2409	3.1367	236.1192	0	0	0	3.1367	3.1367
Sulfuric Acid	0	115.139	115.139	0	0	0	0	115.139	102.3085	0	0	0	0	102.3085	102.3085
Nitrogen	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0016	0.0016
Carbon Dioxide	0	0	0	0	1.1096	0	0	0	0	0	0	0	0	877.2455	877.2455
Oxygen	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0009	0.0009
Ammonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lactic Acid	1.733	2268.6788	2268.679	0	0	0	0	2266.4819	2010.4273	1.3676	0	0	0	2010.4275	2010.4275
Acetic Acid	537.7159	4084.1736	4084.1727	0	0	0	0	3552.2003	1924.0465	178.6808	0	0	0	1924.0454	1924.0454
Methane	0	0	0	0	0	0	0	0	0	0	0	0	0	347.2569	347.2569
Nitrogen Dioxide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sulfur Dioxide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DAP	0	202.4815	202.4815	0	0	0	0	202.4815	0	0	0	0	0	0	0

Stream No.	8040	8042	8043	8044	8045	8047	8049	8597	8692	8812	8813	8815	8816	8818	8819
Stream Name	FLUE GAS							Mol Sieve							
Temp C	165.3185	25.0489	220	48.7963	820	639.5961	270	147.74	120.6474	267.9948	177	307.9216	301.4922	299.7772	299.7772
Pres bar	0.9686	1.0234	1	1	0.9686	0.9686	0.9686	4.4786	2.0265	13.1722	98.9236	98.2346	87.7474	87.7474	87.7474
Enth MW	-429.03	-0.01048	10.351	-326.68	-349.28	-372.63	-417.2	-2.1204	-6.2795	-448.67	-541.4	-518.81	-470.21	-520.46	-504.85
Vapor mass fraction	1	1	1	0.76943	1	1	1	0	0	1	0	0	0.99969	0	0
Total kg/h	317001.079	205000	213776.27	316989.512	317001.136	317001.079	317001.079	497	1460.8174	124160	128000	128000	128000	128000	124160
Flowrates in kg/h															
Glucose	0	0	0	56.8544	0	0	0	0	0	0	0	0	0	0	0
Cellulose	0	0	0	7015.2184	0	0	0	0	0	0	0	0	0	0	0
Xylose	0	0	0	648.1553	0	0	0	0	0	0	0	0	0	0	0
Xylan	0	0	0	3949.0553	0	0	0	0	0	0	0	0	0	0	0
Lignin	0	0	0	3579.966	0	0	0	0	0	0	0	0	0	0	0
Acetate	0	0	0	548.6106	0	0	0	0	0	0	0	0	0	0	0
Organism	0	0	0	555.8557	0	0	0	0	0	0	0	0	0	0	0
Solslds	0	0	0	8383.7504	0	0	0	0	0	0	0	0	0	0	0
Gypsum	0.4063	0	0	0.4063	0.4063	0.4063	0.4063	0	0	0	0	0	0	0	0
Lgnsol	0	0	0	669.8354	0	0	0	0	0	0	0	0	0	0	0
HMF	0	0	0.0001	109.833	0	0	0	0	0	0	0	0	0	0	0
C5Sugar	0	0	0	994.7263	0	0	0	0	0	0	0	0	0	0	0
C6Sugar	0	0	0	2568.4757	0	0	0	0	0	0	0	0	0	0	0
C5Solid	0	0	0	551.1934	0	0	0	0	0	0	0	0	0	0	0
C6Solid	0	0	0	655.3348	0	0	0	0	0	0	0	0	0	0	0
CaH2O2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ash	1043.2097	0	0	1043.2097	1043.2097	1043.2097	1043.2097	0	0	0	0	0	0	0	0
Ethanol	0	0	1.1023	1.497	0	0	0	0	0	0	0	0	0	0	0
Water	83693	0	391.1629	67009.0732	83693	83693	83693	497	1460.8174	124160	128000	128000	128000	128000	124160
Furfural	0	0	4.1699	7.3065	0	0	0	0	0	0	0	0	0	0	0
Sulfuric Acid	102.3084	0	0	102.3085	102.3085	102.3084	102.3084	0	0	0	0	0	0	0	0
Nitrogen	168969.777	161950	168469	168469	168969.792	168969.777	168969.777	0	0	0	0	0	0	0	0
Carbon Dioxide	51734.942	0	17.9352	895.1807	51735	51734.942	51734.942	0	0	0	0	0	0	0	0
Oxygen	11430.4258	43050.0018	44890.871	44890.8745	11430.4329	11430.4258	11430.4258	0	0	0	0	0	0	0	0
Ammonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lactic Acid	0	0	0.0009	2010.4286	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	2.0409	1926.0861	0	0	0	0	0	0	0	0	0	0	0
Methane	0	0	0	347.2569	0	0	0	0	0	0	0	0	0	0	0
Nitrogen Dioxide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sulfur Dioxide	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DAP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2-2-4-TriMth-C5	27.0875	0	0	0	27.0875	27.0875	27.0875	0	0	0	0	0	0	0	0

Stream No.	8821	8823	8830	8872	8873	9611
Stream Name	BLR BLOWDOWN			TO U1100		
Temp C	321	267.9948	267.9948	137	137	179.8844
Pres bar	113.484	13.1722	13.1722	3.3437	3.3437	10
Enth MW	-16.67	-36.136	-307.58	-123.28	-547.74	-111.95
Vapor mass fraction	1	1	1	0	0	0.60031
Total kg/h	4521	10000.001	85117.4729	28809.9194	128000	28809.6111
Flowrates in kg/h						
Glucose	0	0	0	0	0	0
Cellulose	0	0	0	0	0	0
Xylose	0	0	0	0	0	0
Xylan	0	0	0	0	0	0
Lignin	0	0	0	0	0	0
Acetate	0	0	0	0	0	0
Organism	0	0	0	0	0	0
Solslds	0	0	0	0	0	0
Gypsum	0	0	0	0	0	0
Lgnsol	0	0	0	0	0	0
HMF	0	0	0	0	0	0
C5Sugar	0	0	0	0	0	0
C6Sugar	0	0	0	0	0	0
C5Solid	0	0	0	0	0	0
C6Solid	0	0	0	0	0	0
CaH2O2	0	0	0	0	0	0
Ash	0	0	0	0	0	0
Ethanol	0	0	0	0	0	0
Water	4521	10000.001	85117.4729	28809.9194	128000	28809.6111
Furfural	0	0	0	0	0	0
Sulfuric Acid	0	0	0	0	0	0
Nitrogen	0	0	0	0	0	0
Carbon Dioxide	0	0	0	0	0	0
Oxygen	0	0	0	0	0	0
Ammonia	0	0	0	0	0	0
Lactic Acid	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0

Pacific Northwest
NATIONAL LABORATORY

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