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Techno-economic Analysis for the Thermochemical Conversion of Lignocellulosic Biomass to Ethanol via Acetic Acid Synthesis

Y Zhu
SB Jones

April 2009

Pacific Northwest
NATIONAL LABORATORY

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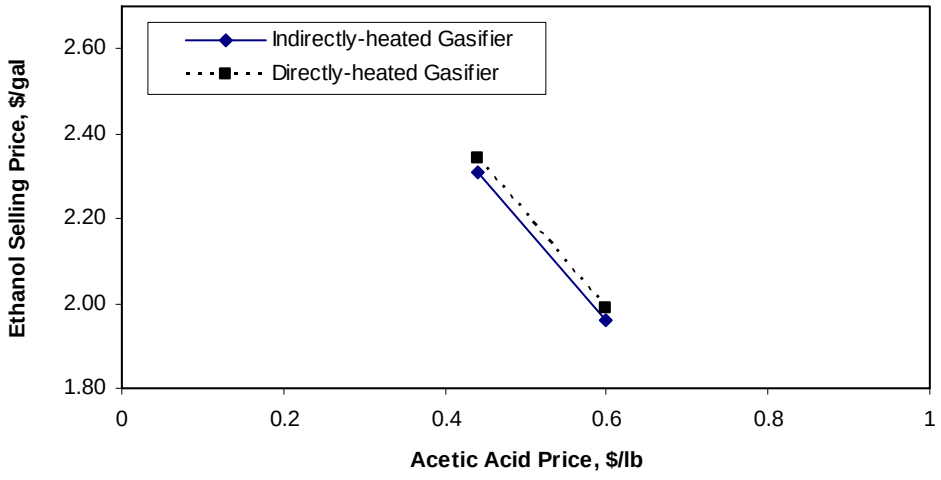
Summary

Biomass is a renewable energy resource that can be converted into liquid fuel suitable for transportation applications. As a widely available biomass form, lignocellulosic biomass can have a major impact on domestic transportation fuel supplies and thus help meet the Energy Independence and Security Act renewable energy goals (EISA 2007).

This study is a techno-economic analysis of the thermo chemical conversion of biomass to ethanol, through methanol and acetic acid, followed by hydrogenation of acetic acid to ethanol. The conversion of syngas to methanol and methanol to acetic acid are well-proven technologies with high conversions and yields. This study was undertaken to determine if this highly selective route to ethanol could provide an already established and economically attractive route to ethanol.

The feedstock was assumed to be wood chips at 2000 metric ton/day (dry basis). Two types of gasification technologies were evaluated: an indirectly-heated gasifier and a directly-heated oxygen-blown gasifier. Process models were developed and a cost analysis was performed. The carbon monoxide used for acetic acid synthesis from methanol and the hydrogen used for hydrogenation were assumed to be purchased and not derived from the gasifier. Analysis results show that ethanol selling prices are estimated to be $2.79/gallon and $2.81/gallon for the indirectly-heated gasifier and the directly-heated gasifier systems, respectively (1stQ 2008$, 10% ROI). These costs are above the ethanol market price for the concurrent time period ($1.50 - $2.50/gal).

The co-production of acetic acid greatly improves the process economics as shown in the figure below. Here, 20% of the acetic acid is diverted from ethanol production and assumed to be sold as a co-product at the prevailing market prices ($0.40 - $0.60/lb acetic acid), resulting in competitive ethanol production costs.



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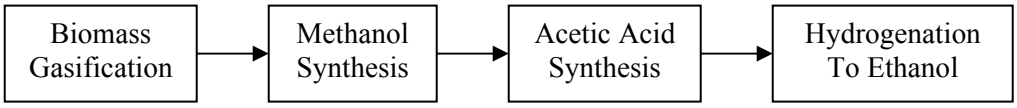
1.0 Introduction

Biomass is an important domestic resource that has the potential to make a significant impact on domestic fuel supplies and thus help meet the Energy Independence and Security Act renewable energy goals (EISA 2007). This study is part of an ongoing effort within the Department of Energy to meet the renewable energy goals for liquid transportation fuels. In particular, this report assesses the potential for ethanol production from biomass via commercially available catalysts

Biomass conversion to synthesis gas by gasification has been demonstrated. The syngas, rich in CO and H_2, can be further used to produce methanol, ethanol or other chemicals and liquid fuels. Among these products, methanol has been widely used as a solvent and also as the raw material for many chemicals and liquid fuels. Syngas can also be converted to ethanol via mixed alcohol synthesis (Aden, *et al*. 2005; Phillips, *et al*. 2007). While mixed alcohol synthesis is an important and ongoing research area, it has not yet reached commercial readiness. In this study, commercially established methanol and acetic acid synthesis processes are evaluated as an alternative to mixed alcohols synthesis. The process involves the following steps:



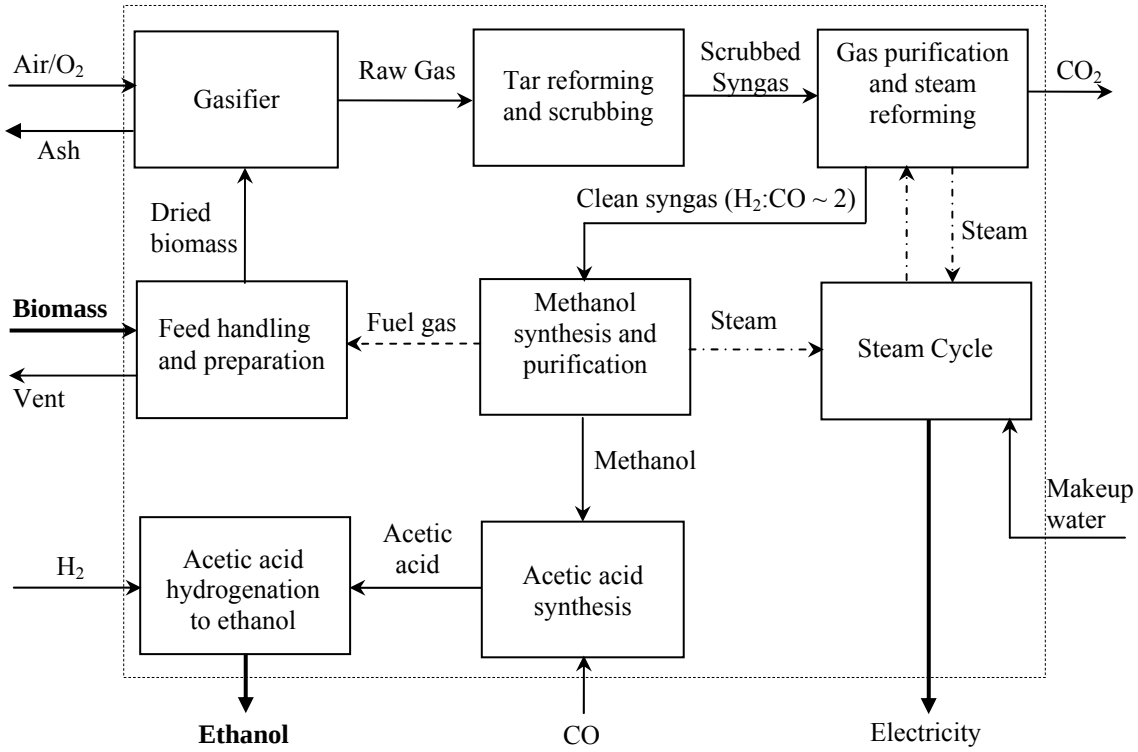
The methanol and acetic acid steps are well established and have high yields (Cheng, 1994 and Jones, 2000). Although acetic acid hydrogenation to ethanol is not yet commercially practiced, it is a highly selective process as well.

Many techno-economic assessments have been conducted for biomass gasification to produce a number of products including methanol (Hamelinck and Faaij, 2001), Fischer-Tropsch liquid based transportation fuels (Hamelinck *et al*., 2003), hydrogen (Hamelinck and Faaij, 2001; Spath, *et al*., 2005), and ethanol via mixed alcohol synthesis (Aden *et al*., 2005; Phillips, *et al*., 2007). Although methanol and acetic acid syntheses have been commercially available for many years, their integration with a biomass gasifier has not been developed and or proved. Therefore, a techno-economic evaluation was conducted to provide insights into benefits and risks of this process.

2.0 Process Design Basis and Modeling Approach

A simplified block diagram of the overall design for the biomass-to-ethanol via acetic acid system is given in Figure 2-1. Two gasification technologies are evaluated: an indirectly-heated, entrained-bed gasifier and a directly-heated, pressurized, fluidized bed gasifier. Wood chips are converted to synthesis gas in the gasifier. Then syngas is sent to a tar reformer and a scrubber. Syngas, free of tars and particulates, is sent to a sulfur removal unit to remove sulfur compounds. Then clean syngas is sent to a steam reformer to convert CH_4 to H_2 and CO, and to adjust the H_2:CO ratio to that required by methanol synthesis. The syngas is then compressed and sent through the methanol synthesis process. The methanol product is purified and sent to the acetic acid synthesis process. Acetic acid is generated by the reaction of methanol with CO. The acetic acid product is then sent to the ethanol synthesis process to produce ethanol by hydrogenation. Ethanol is separated from the product stream of the hydrogenation process and dried with a molecular sieve to obtain purified ethanol. Steam generated in each process area is collected and sent to the steam cycle for power generation. Part of the steam from the steam cycle is used in the steam reforming, distillation reboilers, and other processes.

Figure 2-1 Simplified Conceptual Diagram of Biomass-to-Ethanol based on Gasifier System



2.1 Process Design Basis

The biomass-to-ethanol via acetic acid system consists of eight main processes. The design bases for the main processes are described in following sections. Detailed flow diagrams and heat and material balances are given in the Appendix.

2.1.1 Feed Handling and preparation

The feedstock is assumed to be wood chips with a moisture content of 50 wt%. The wood feed rate is 2000 dry metric ton/day. The wet wood chips enter rotary dryers and are dried to a moisture content of 12 wt%. The feed handling system is based on a previous study using wood as a feedstock (Spath, *et al.*, 2005). The two gasifier types used in this study are described below. Each employs a different strategy to dry the feedstock. For the indirectly-heated gasifier process, the heat of the hot flue gas from the char combustor is used for biomass drying. For the directly-heated gasifier, the heat of the flue gas from the char combustor is not sufficient for drying the feedstock. Therefore, the dryer is assumed to have a burner that can heat air using off-gas from the methanol synthesis process as fuel. The dried biomass is then conveyed to the gasifier.

2.1.2 Gasification

Two types of gasifiers are considered in this study. The indirectly-heated gasifier comprises both a gasifier and a combustor. Dried wood is fed into a low-pressure, indirectly-heated, entrained flow gasifier. Steam extracted from steam cycle is sent to the gasifier at a flow rate of 0.4 lb of steam/lb of dry wood to fluidize the bed and to supply a portion of the heat required for the gasifier. The gasifier is assumed to be operated at 870^{o}C (1598 ^{o}F) and 23 psia. The gasifier is mainly heated by circulating olivine particles between the gasifier and the separate combustor (Spath, *et.al.* 2005). Char formed in the gasifier is entrained in the process stream and carried out of the gasifier, along with the olivine Both are separated from the process stream in a series of cyclones and sent to the fluidized bed combustor, where air is used to burn the char thereby reheating the olivine.

The directly-heated, oxygen-oxygen blown gasifier is a pressurized, fluidized bed gasifier that also uses steam to fluidize the gasifier bed and to provide a portion of the heat. A pressurized, cryogenic air separation unit provides purified oxygen at 99.5% for the gasifier at 350 psia and 16^{o}C (60^{o}F). The mass flow rate of oxygen is varied to achieve a gasifier outlet stream temperature of 871^{o}C (1600^{o}F). The dried wood is fed using a lock hopper feeder system and pressurized CO_2 recovered from the gas purification process. The CO_2 gas used in the lock hopper is fed at a flow rate of 0.03 lb of CO_2/lb dry wood and compressed to 330 psi. A small amount of MgO is also added to the gasifier to react with potassium in the ash and prevent agglomeration in the gasifier bed.

The indirectly-heated gasifier was modeled using the correlations reported in Spath, *et al.* (2005) based on data from the Battelle-Columbus Laboratory (BCL) process development unit gasifier. The performance of the directly-heated oxygen-blown pressurized gasifier was predicted using correlations based on the experimental data from an IGT (Institute of Gas Technology) gasifier (Evans, *et al*. 1988). Detailed design information of these two gasifiers are described in references of Spath, *et al*. (2005), Evans, *et al.* (1988), Aden, *et al*. (2005), and Phillips, *et al*. (2007).

2.1.3 Tar reforming and gas scrubbing

During gasification, a relatively small fraction of biomass is converted into tars consisting mostly of aromatic and poly-aromatic hydrocarbons. The nitrogen in the biomass is converted to ammonia. Therefore raw syngas from the cyclone in the gasifier section is sent to a catalytic tar cracker, which is assumed to be a bubbling fluidized bed reactor. A portion of the syngas tar, methane, and other light hydrocarbons in the raw gas are converted to CO and H_2, and some of the ammonia is converted to N_2 and

H_2. The conversion percentage for each compound is modeled as reported in Spath, *et al*., (2005). The gas enters the tar reformer at the gasifier outlet temperature and exits the reformer at 750°C (1,383°F). The syngas is further cooled to 149°C (300°F) and sent to a wet scrubber to remove other impurities, such as particulates, residual ammonia and residual tars.

2.1.4 Gas purification and steam reforming

The scrubbed syngas is compressed to 450 psia. A liquid phase oxidation (LO-CAT) process followed by a ZnO bed is used to remove sulfur that would otherwise poison downstream catalysts. The LO-CAT process is assumed to reduce sulfur to a concentration of 10 ppm H_2S, and then the ZnO bed polishes the syngas to less than 1 ppmv (Spath, *et al.* 2005) sulfur.

Syngas leaving the ZnO bed is sent to a steam reformer to convert the remaining methane and light hydrocarbons to additional syngas and to adjust the H_2:CO ratio via the water-gas shift reaction. The main steam reformer reactions are:

$$C_nH_m + nH_2O \leftrightarrow (n+m/2)H_2 + nCO \quad (1)$$

$$CO + H_2O \leftrightarrow CO_2 + H_2 \quad (2)$$

Before the syngas is sent to the steam reformer, it is mixed with high temperature steam from the steam cycle and steam generated by the methanol synthesis reactor. Reactions take place between 800 and 900°C (1472 and 1652 °F). The steam reformer is fired with off-gas from the methanol synthesis section purge and the MTG syntheses section. The H_2: CO ratio is adjusted to ~ 2, as required by the methanol synthesis reaction. The converted syngas passes through several heat exchangers to recover heat by generating saturate high pressure steam and superheated high pressure steam. The cooled syngas from the reforming process is further cooled by air cooling and cooling water. Excess CO_2 (~90%) is removed in an amine unit. The clean syngas is then compressed to 1450 psia.

2.1.5 Methanol synthesis and purification

The compressed clean syngas is sent to a low-pressure methanol synthesis process. The principle methanol synthesis reactions are:

$$CO + 2H_2 \leftrightarrow CH_3OH \quad (3)$$

$$CO_2 + 3H_2 \leftrightarrow CH_3OH + H_2O \quad (4)$$

The first reaction is the primary methanol synthesis reaction, and the second one represents a small fraction of carbon dioxide in the feed that acts as a promoter for the primary reaction.

The syngas from the steam reformer is compressed and preheated before entering the methanol reactor. Methanol synthesis temperatures and pressures typically range between 230 to 270°C (446 to 578°F) and 735 to 1470 psia, respectively (Cheng, 1994, Fiedler, *et al*., 2000). The methanol reactor is assumed to be

isothermal, low-pressure (850 psia), gas-phase shell and tube type with ZnO/CuO catalyst in the tubes. The methanol synthesis reaction is highly exothermic and reaction heat is removed by generating medium pressure steam on the shell side of the reactor. The hot reactor product vapor is cooled by recycled compressed syngas and further cooled by air and then cooling water. The product stream is sent to a flash tank where liquid raw methanol is separated from the non-condensable gases. Approximately ninety-five percent of the vapor phase is compressed and recycled to the methanol reactor. The liquid product is further reduced in pressure to yield raw methanol at about 95 wt% purity.

The raw methanol is distilled to 99.5 mol% purity. Ninety percent of the vapor phase stream is compressed and recycled to the methanol reactor. The remaining gas is purged from the loop and combined with the off-gas from the distillation column. The purged gas is used as fuel gas for the steam reformer.

2.1.6 Acetic acid synthesis

High purity methanol is sent to an acetic acid synthesis reactor. In this process, methanol is converted to acetic acid by the following carbonylation reaction:

$$CH_3OH + CO \leftrightarrow CH_3COOH \quad (5)$$

The acetic acid synthesis process in this study is based on the Cativa process. This technology has been well established and has high selectivity and yields (Jones, 2000, SRI PEP 2003). This process employs a proprietary iridium- and iodide-based catalyst with a CO conversion of 91.5% (SRI PEP 2003).

Methanol with 99.5 mol% purity from the methanol synthesis process is compressed to 470 psi and then sent to the acetic acid synthesis reactor with makeup catalyst. The purchased, compressed CO is sent to the bottom of the synthesis reactor. The reaction conditions are liquid phase at 189^{o}C (372^{o}F) and 450 psi. The heat generated from the reaction is controlled by heating boiler feed water to generate steam.

The hot effluent stream from the reactor is cooled by the inlet methanol stream. The cooled effluent stream is flashed at 35 psi to separate the liquid product from the vapor product. The vapor phase stream containing acetic acid, methyl iodide, methyl acetate, and non-condensable gases of CO, H_2, and etc, is fed to the lower portion of the product purification column. The liquid phase stream from the flash tank is pumped and recycled to the reactor. In the product purification column, the overhead stream from the column is condensed, and the condensate is sent to a separator. A large part of the condensate is refluxed to the column, and the remainder is recycled to the reactor. The non-condensable gas stream is sent to a gas scrubber and the bottom product, containing a large portion of the catalyst, is recycled to the reactor. The overhead stream with non-condensable gases is sent to the fuel gas system. The bottom product from the purification column is 98 mol% acetic acid, with traces of water and other impurities. The purified acetic acid is sent to the ethanol synthesis process.

2.1.7 Ethanol synthesis and purification

Ethanol is produced by hydrogenation of acetic acid under high pressure in the ethanol synthesis step. The principle reaction is:

$$CH_3COOH + 2H_2 \leftrightarrow CH_3CH_2OH + H_2O \quad (6)$$

A continuous process for ethanol synthesis by hydrogenating acetic acid was developed by Schuster, *et al.* (1985), and it is chosen as the design basis for the ethanol synthesis process in this study. This process features a high ethanol yield of 97% and a low reaction pressure compared to other acetic acid hydrogenation processes (Schuster, *et al.* 1985).

The process developed by Schuster, *et al.* (1985) is a gas phase hydrogenation reaction under high pressure and high temperature, wherein a predominantly cobalt-containing catalyst is used. The reaction temperature is between 230 and 270^{o}C (446 and 518^{o}F), and pressure is between 40 ~ 120 bar (Schuster, *et al*., 1985). Hydrogen, at a ratio of 2.1: 1 in terms of H_2: acetic acid, is compressed and sent to the reactor with pumped acetic acid. The inlet stream is heated by a fired heater and then sent to the ethanol reactor. The reaction heat is recovered by generating low pressure steam. The hot effluent is pre-cooled by the inlet stream. The effluent is further cooled by air cooling. The cooled stream is sent to a flash tank. 98% of the recovered vapor phase stream is compressed and recycled to the reactor and the remaining is purged as fuel gas. The liquid phase stream is further flashed at 35 psia, and the bottom stream is sent to the purification area. The vapor stream, from this second flash is recovered for use as fuel. The raw ethanol stream contains about 68 wt% ethanol, 29 wt% water, and small amounts of ethyl acetate, n-butanol, and acetic acid. Ethanol is purified to the water-ethanol azeotrope by distillation, and then further dried in a molecular sieve. The product ethanol is 95.8% pure, with the main impurity being ethyl acetate.

2.1.8 Power generation

Saturated steam is generated by heat recuperation from the gasifier, steam reformer and synthesis areas. Saturated steam is superheated and sent to a steam turbine to generate power for the entire process as well as excess power for sale. Process steam is also extracted from the turbines.

2.2 Analysis Approach

The process simulation for the gasifier based biomass-to-ethanol via acetic acid synthesis system was developed in CHEMCAD. Based on the performance simulation results from CHEMCAD, the capital and operating costs were assembled in an EXCEL spreadsheet cost model. A simple return on investment calculation was used to estimate the product selling price.

3.0 Simulation and Economic Assumption

In this section, the main assumptions for the performance simulation and cost analysis are described.

3.1 Simulation Assumptions

Table 3-1 shows the main assumptions for the indirectly-heated gasifier and directly-heated gasifier based systems.

Table 3-1 Operating Conditions Used in the Simulations

Gasifier Type	Indirectly-Heated Gasifier	Directly-Heated Gasifier
Gasifier Pressure, psi	23	330
Gasifier Temperature, °F	1598	1600
Biomass Feed, metric ton/d, bone dry	2000	2000
Oxidant	Air	Oxygen
Dried Biomass, moisture fraction %	12	12
Tar Reformer, °C (°F)/P, psia	717 (1323) / 20	717 (1323) / 327
Steam Reforming		
Reformer outlet temperature, °C (°F)	900 (1652)	
Pressure, psia	435	
H_2:CO	2.1	
Methanol Synthesis and Purification		
Outlet temperature, °C (°F)	260 (500)	
Pressure, psia	1450	
% of off-gas recycled	90	
Methanol Purity, mol%	99.5	
Acetic Acid Synthesis and Purification		
Temperature, °C (°F)	189 (372)	
Pressure, psia	465	
CO: Methanol, molar ratio	1.1	
Acetic Acid Purity, mol%	98	
Ethanol Synthesis and Purification		
Temperature, °C (°F)	250 (482)	
Pressure, psia	880	
H_2:Acetic Acid, molar	2.1	
% of off-gas recycled	98	

3.2 Economic Assumptions

Most of the base equipment costs for the gasification, gas purification and conditioning, and steam cycle and power generation sections of the plant were obtained from Spath, *et al.* (2005) and Hamelinck and Faaij (2002). The cost assumptions for methanol synthesis, acetic acid synthesis, and ethanol synthesis are based on other literature and initial calculations (SRI PEP, 2007; Hamelinck and Faaij, 2001).

All capital costs are reported in 1st quarter 2008 dollars. Equipment cost escalation is calculated using Chemical Engineering Plant Cost Indices (CEPCI) published in the Chemical Engineering magazine. The total capital investment is factored from the total purchased equipment cost (TPEC) based on SRI PEP (2007). The factors are shown in Table 3-2. Table 3-3 lists the assumptions used to estimate the production costs. The hydrogen for the hydrogenation reactor and the carbon monoxide consumed in the acetic acid reactor are assumed to be purchased. 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. The CO purchasing cost is assumed to be triple that of the price from SRI PEP (2007) because the price listed represents an internal transfer price, which may not reflect the commercial delivery price.

Table 3-2 Project Investment Factors

	% or TPEC
Total Purchased Equipment Cost (TPEC)	100%
Purchased Equipment Installation	39%
Instrumentation and Controls	26%
Piping	31%
Electrical Systems	10%
Buildings (including services)	29%
Yard Improvements	12%
Total Installed Cost (TIC)	247%
Indirect Costs	
Engineering	32%
Construction	34%
Legal and Contractors Fees	23%
Project Contingency	37%
Total Indirect	126%
Total Project Investment	373%

Table 3-3 Operating Cost Assumptions

	Value	Units or Basis	Reference
Raw Materials			
Hybrid poplar chips	60	$/dry short ton	Aden, 2008
Olivine makeup	172.9	$/short ton	Phillips, *et al.* 2007
Ash disposal	18	$/short ton	Phillips, *et al.* 2007
Hydrogen	5.9	$/1000scf	SRI PEP 2007
Carbon monoxide	11.7 [a]	$/1000scf	SRI PEP 2007
Tar cracker catalyst	4.67	$/lb catalyst	Aden, *et al.* 2005
Reformer catalyst	21.9	$/lb catalyst	SRI PEP 2007
Methanol catalyst	8.37	$/lb catalyst	SRI PEP 2007
Acetic acid synthesis catalyst	0.01	$/lb acetic acid	SRI PEP 2007
Hydrogenation catalyst	18.975	$/lb catalyst	SRI PEP 2007
Utilities			
Waste water treatment	2.1	$/100 ft^3	Phillips, *et al.* 2007
Cooling water	10.9	¢/1000 gal	SRI PEP 2007
Natural gas	9.17	$/1000 scf	EIA, 2008a
Electricity	6.38	¢/kWh	EIA, 2008b
Labor			
Operating labor	42.5	$/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		Estimated
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 & insurance	2%	of total fixed capital	SRI PEP 2007
General & administrative	5%	of product value	SRI PEP 2007
Stream factor	90%		
Construction	Overnight[b]		
Plant life	20	years	
Depreciation	20	years straight line	
Rate of return on capital	10%		

[a] The CO price is assumed to be three times the internal transfer price listed in SRI PEP 2007 to estimate an industrial delivery price; [b] "overnight construction" means no costs are associated with the construction phase, that is, construction is as if it happens "overnight".

4.0 Results and Discussion

This section describes the main performance and cost simulation results of biomass-to-ethanol via acetic acid systems based on the two different gasifiers.

4.1 Performance Results and Discussion

Table 4-1 gives the main performance results for the biomass-to-ethanol via acetic acid based on the two different gasifiers systems.

Table 4-1 Performance Analysis Results

Case	Indirectly-Heated Gasifier	Directly-Heated Gasifier
Gasifier Pressure, psi	23	330
Gasifier Temperature, °C (°F)	870 (1598)	870 (1600)
Scrubbed syngas H_2:CO ratio	0.9	1.4
Char production, lb/hr	33,970	7510
Feed		
Wood chips, metric ton/day, dry basis	2000	2000
Hydrogen, lb/h	11,297	13,697
Carbon monoxide, lb/h	82,433	99,940
Natural Gas, lb/hr	--	14,278
Products		
Ethanol, mmgal/y	145	176
Power Consumption, MW		
Air separation unit	--	-8.6
Lock hopper gas compressor	--	-0.2
Dryer air blower	--	-0.2
Air compressor	-4.8	-0.9
Syngas compressor	-16.9	-1.9
Reformer air compressor	-2.1	-3.4
Reformer flue gas blower	-0.4	-0.7
Clean syngas compressor	-6.0	-7.4
Recycle compressor	-0.4	-0.3
H_2 Compressors	-3.0	-3.6
Steam turbines	32.7	41.3
Net power, MW	**-0.9**	**14.2**
Carbon Efficiency, %	**49.8**	**53.0**
Thermal Efficiency, %, higher heating value (HHV) basis	**60.7**	**61.9**

Compared to the indirectly-heated gasifier based system, the directly-heated gasifier based system has higher ethanol production, higher power output, higher carbon efficiency, and slightly higher thermal efficiency. The thermal efficiency at higher heating value basis is defined as the total energy output of power generation and energy in the product divided by the total energy input of biomass. The H_2: CO

ratio in syngas for the directly-heated gasifier is higher than that of the indirectly-heated gasifier, and the char production of the former is less than the latter. This is because of the differences in gasification temperatures and pressures. Part of this effect may be due the need for supplemental natural gas added to the fuel gas system that supplies the steam reformer and the biomass dryer in the directly-heated gasifier case. Also, lower char production results in more carbon available for the final product synthesis. Therefore, the carbon efficiency and ethanol yield of the directly-heated gasifier system are higher. The higher H_2: CO ratio in syngas leads to less steam needed in the steam reformer for adjusting the H_2: CO ratio to approximately 2 (required for methanol synthesis). Therefore, more steam is available for power generation in the directly-heated gasifier based system than that of the indirectly-heated gasifier.

Both of the cases have high carbon efficiency and high thermal efficiency. The efficiency for the directly-heated gasifier would be much lower if fuel gas were used instead of natural gas in the biomass dryer. Yields for both gasifiers would also be lower if the carbon monoxide and hydrogen used in the acetic acid and ethanol steps were derived from the syngas rather than externally purchased.

4.2 Cost Results and Discussion

Table 4-2 shows the capital cost breakdown for each section of the plant and the operating cost. The cost of the acetic acid production and hydrogenation unit is the biggest fraction of total equipment cost. The other two areas that have the second and third highest cost are gasification and methanol synthesis processes. The total equipment cost for the directly-heated gasifier based system is about 24.5% higher than that of the indirectly-heated gasifier based system. This is mainly due to the need for a pressurized gasifier and an air separation plant. In addition, as a result of higher syngas flow rates and thus larger acetic acid throughput for the directly-heated gasifier based system, the equipment cost for acetic acid production is also higher than that of the indirectly-heated gasifier system. As a result, the total project investment for the directly-heated gasifier based system is higher than that of indirectly-heated gasifier based system.

The main operating cost results are also listed in Table 4-2. The two systems have almost the same operating costs. Although the capital cost of the directly-heated gasifier based system is higher, the operating cost is almost the same for the two systems because the ethanol yield for the directly-heated gasifier based system is higher. The ethanol selling price of the directly-heated gasifier based system is slightly higher. The variable costs of purchasing H_2 and CO represent the largest percentage of total raw material costs, which are 77% and 80% for the two systems, respectively. The variable costs represent about 77% of the total production costs for each system. Because of high variable costs, the ethanol selling prices for both systems were higher than the ethanol market price during 2007-2008, which ranged from $1.55 to over $2.50 (ICIS Pricing). Therefore, the estimated ethanol selling price is not competitive with the ethanol market prices in the past year.

Because of the high costs related to purchasing H_2 and CO, an alternative design was considered. The design assumed that H_2 and CO were produced internally by separating H_2 and CO from the clean syngas. Thus the syngas used for methanol and ethanol synthesis was decreased and the ethanol yield was greatly reduced. This alternative system design was not simulated in process models, but the cost was estimated by reducing related equipment sizes proportionally and adding new equipment costs for H_2 and CO production. The final results showed lower ethanol selling prices than the base cases, competitive with

the current ethanol market price because the production cost of H_2 and CO is lower than their purchased cost. Therefore, this alternative design should be considered for further investigation.

Table 4-2 Capital and Operating Cost Summary

Case	Indirectly-Heated Gasifier		Directly-Heated Gasifier	
Equipment Costs	mm$	% of Total	mm$	% of Total
Air separation unit	--	--	$10	5%
Feed prep and drying	$10	7%	$12	6%
Gasification with tar reforming, heat recovery, scrubbing	$21	14%	$41	21%
Syngas compression	$9	6%	$1	0%
Sulfur removal	$2	1%	$2	1%
Steam reforming & heat recovery	$9	6%	$11	6%
Amine treatment	$7	5%	$15	8%
Feed gas compression	$4	2%	$2	1%
Methanol synthesis & separation	$28	18%	$28	15%
Acetic acid production and hydrogenation	$55	35%	$59	31%
Steam system and power generation	$8	5%	$10	5%
Remainder off-site battery limits (OSBL)	$2	1%	$2	1%
Total Purchased Equipment Cost (TPEC)	$155	100%	$193	100%
Total Installed Cost (TIC), mm$	$383		$476	
Total Indirect Cost, mm$	$195		$243	
Total Project Investment, mm$	$578		$720	
Operating Costs				
Raw Material Cost	$/gal	% of total	$/gal	% of total
Hydrogen	0.68	38%	0.68	39%
Carbon monoxide	0.71	39%	0.71	41%
Wood	0.30	17%	0.22	13%
Others	0.13	6%	0.12	7%
Total	1.81	100%	1.74	100%
Total variable cost, $/gal gasoline	1.83		1.85	
Fixed costs, $/gal gasoline	0.21		0.21	
Depreciation, $/gal gasoline	0.20		0.20	
Gen & admin, $/gal gasoline	0.14		0.14	
Production cost, $/gal gasoline	2.39		2.40	
Estimated Selling Price, $/gal gasoline	**2.79**		**2.81**	

4.3 Sensitivity Analysis

The following summarizes the results of the sensitivity analysis to determine the effects of the feedstock cost, hydrogen cost, production of acetic acid as a co-product and the gasifier size.

4.3.1 Feedstock Cost

The effect of different wood prices on the ethanol selling price is shown in Figure 4-1.Increasing the wood price from $20 to $100/dry short ton causes the ethanol selling price to increase from about $2.5 to $3/gallon. The ethanol selling price is comparable with the actual ethanol market price (from June 2007 to June 2008 (ICSI pricing)) when the biomass cost is at $20/ton. However, this price is unlikely to be

available for large quantities of biomass. The effect of changing the feed stock cost for the directly-heated gasifier based system is slightly less than that of the indirectly-heated gasifier based system because the wood cost only represents 13% of the total raw material cost of the directly-heated gasifier system, while it is 17% of the raw material cost of another system. For every 100% increase in wood price, the ethanol selling price increases about 3%.

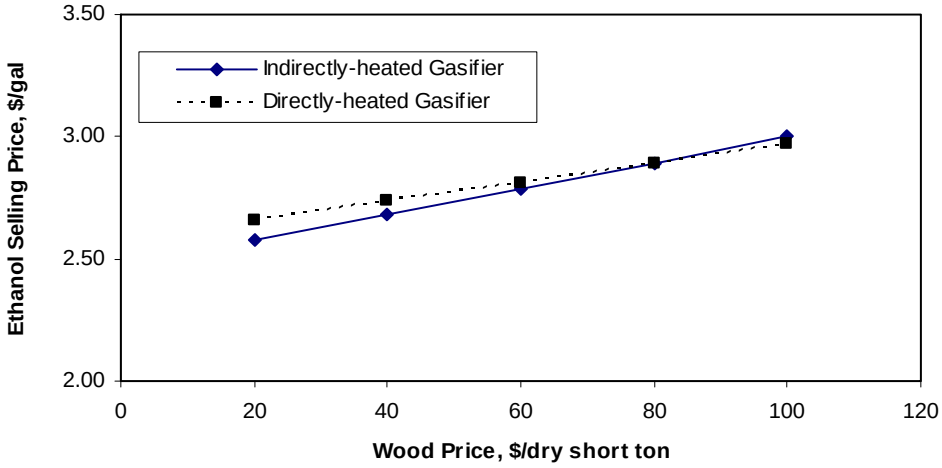


Figure 4-1 Effect of Wood Price on Ethanol Selling Price

4.3.2 Hydrogen Cost

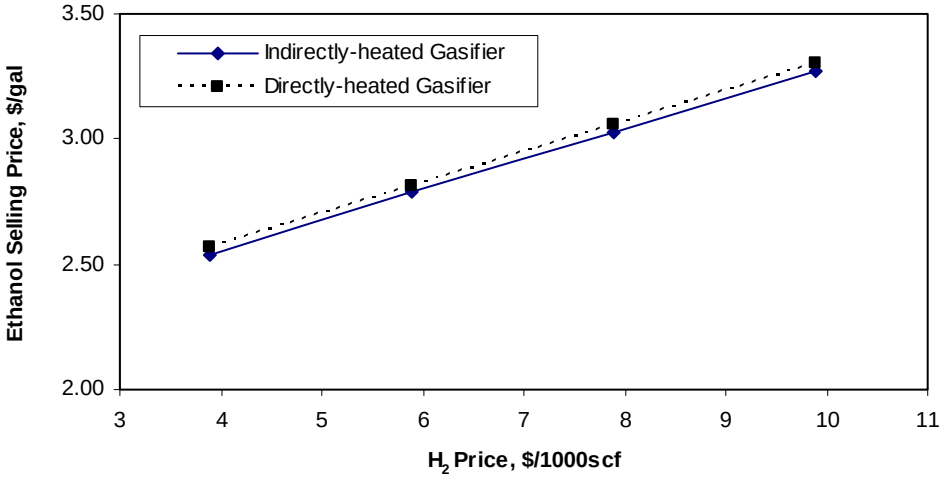


Figure 4-2 Effect of Hydrogen Price on Ethanol Selling Price

Figure 4-2 depicts the effects of hydrogen price variance on ethanol selling price. The ethanol selling price rises from $2.5 to $3.3/gal, when the hydrogen price is increased from $4 to $8 per 1000 scf. The ethanol selling price increases about 18% per every 100 percent increase in hydrogen price. The commercial competitiveness of this biomass-to-ethanol technology is low even if hydrogen price is as low as $4 per 1000 scf.

The cost of hydrogen represents the second largest fraction in the total variable cost for ethanol. Therefore, to enhance the competitiveness of this biomass-to-ethanol technology, low cost hydrogen is important. The Excel based cost model was manipulated to estimate the effect of producing hydrogen and carbon monoxide by diverting some of the syngas to a PSA and cold box. The methanol yield and hence the acetic acid and ethanol yields were also decreased. The cost model suggests that this may be a more attractive alternative, even with the additional capital, than purchased carbon monoxide and hydrogen. A more detailed process and cost simulation should be developed for this design in future.

4.3.3 Acetic Acid Co-production

Figure 4-3 shows the effects of acetic acid price change on ethanol selling price. Acetic acid is the intermediate product for ethanol synthesis. Twenty percent of the acetic acid is assumed to be unconverted and sold as co-product. The acetic acid co-product selling price was varied from $0.44/lb to $0.6/lb. At 20% acetic acid co-production, the ethanol selling price ranges from $2 to $2.3/gallon, which is competitive with the ethanol market price. The acetic acid co-production is approximately 10 lb per gallon of ethanol, which represents a production credit of $4.4/gallon ethanol if the acetic acid price is $0.44/lb. The credit of $4.4/gallon of ethanol is much higher than the ethanol selling price of $2.79/gallon or $2.81/gallon for the base case without any acetic acid co-production. Therefore co-production of acetic acid is an economically attractive means of subsidizing ethanol production.

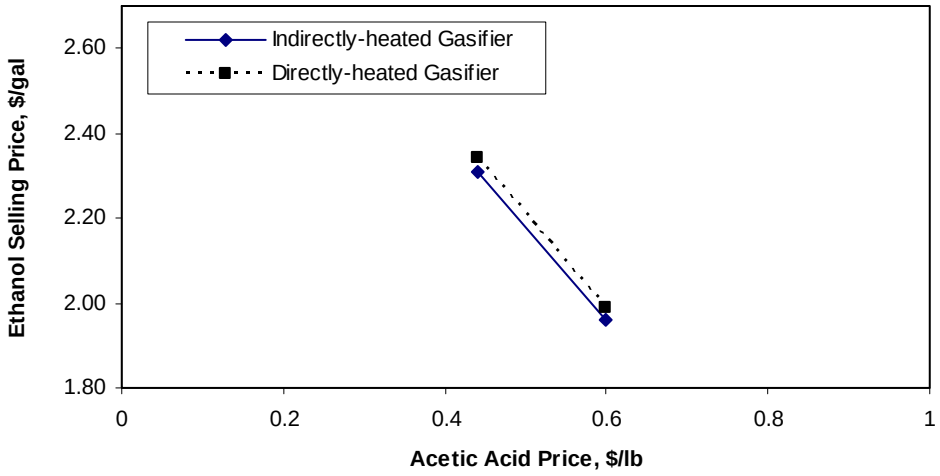


Figure 4-3 Effect of Acetic Acid Price on Ethanol Selling Price

4.3.4 Gasifier Size

To date, the largest biomass gasifier built is less than 500 mtpd in size. It is assumed that these vessels can be scaled to larger sizes. The base case assumes that two 75% gasifiers (1500 mtpd each) operate in parallel to achieve the desired production rate and stream factor. To determine the impact of scale, the number and size of the gasifiers was varied from a single 2000 mtpd gasifier (i.e. 100%) to multiple smaller units, assuming that the stream factor is the same for each case. This is shown in Figure 4-4. It appears that that number and size of the gasifiers has only a small effect on the ethanol selling price. This suggests that for this particular synthesis process, gasifier on stream availability can be had through multiple units without unduly affecting the product price.

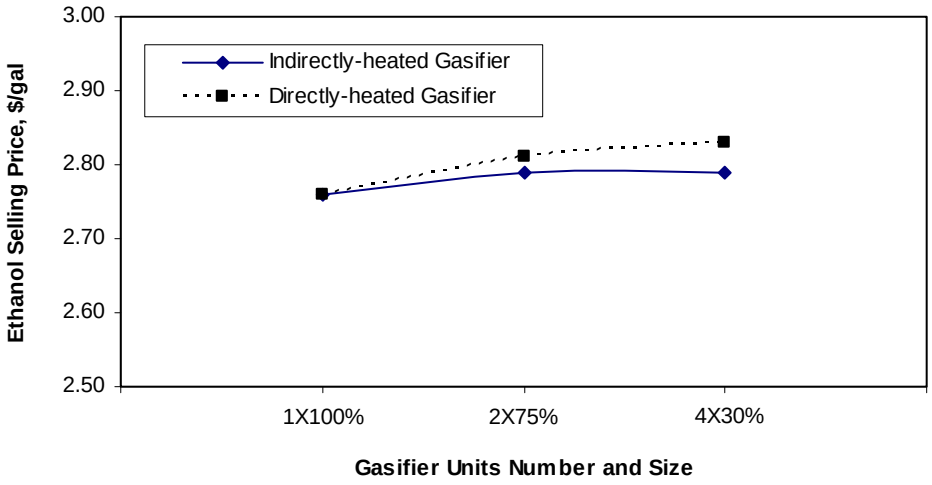


Figure 4-4 Effects of Gasifier Size on Ethanol Selling Price

5.0 Conclusions and Recommendations

A techno-economic analysis was conducted for indirectly-heated and directly-heated gasifier based systems, to produce ethanol from biomass via acetic acid. The estimated ethanol selling prices are not competitive with the recent ethanol market price due to the high costs of hydrogen and carbon monoxide and the high capital investment, unless acetic acid is sold as a co-product. Other conclusions are:

1) Ethanol production alone from acetic acid produced by biomass gasification is not competitive with recent ethanol market prices.
2) The directly-heated gasifier based system has higher thermal and carbon efficiencies than the indirectly-heated gasifier based system due to the use of supplemental natural gas, but has a slightly higher ethanol selling price because of higher gasification equipment cost.
3) The acetic acid production and hydrogenation synthesis steps are the largest contributors to the capital costs.
4) Internal H_2 and CO generation rather than purchase may be a more cost effective way of obtaining H_2 and CO.
5) Sensitivity analysis indicate:
    a. While the wood price has an important effect on the ethanol selling price, the effect of hydrogen price is more significant.
    b. Acetic acid co-production leads to a reduction in the ethanol selling price because acetic acid is a more valuable product with a higher selling price than ethanol. This also reduces the size of the hydrogenation unit, the capital investment and the hydrogen consumption.
    c. Using multiple gasifiers to ensure a high stream factor does not have a significantly detrimental effect on the product cost.

This study provides a preliminary evaluation of an early-entry technology for ethanol production. The sensitivity analysis identifies several key factors that affect the ethanol selling price and thus provides insights for decision making about research and development priorities. Based on these results the following is recommended for further study:

1) Determine the effect of internally produced hydrogen and carbon monoxide
2) Expand the analysis to include a wider range of acetic acid yields and prices

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Appendix A. Heat and Material Balance for the Indirectly-heated Gasifier Case

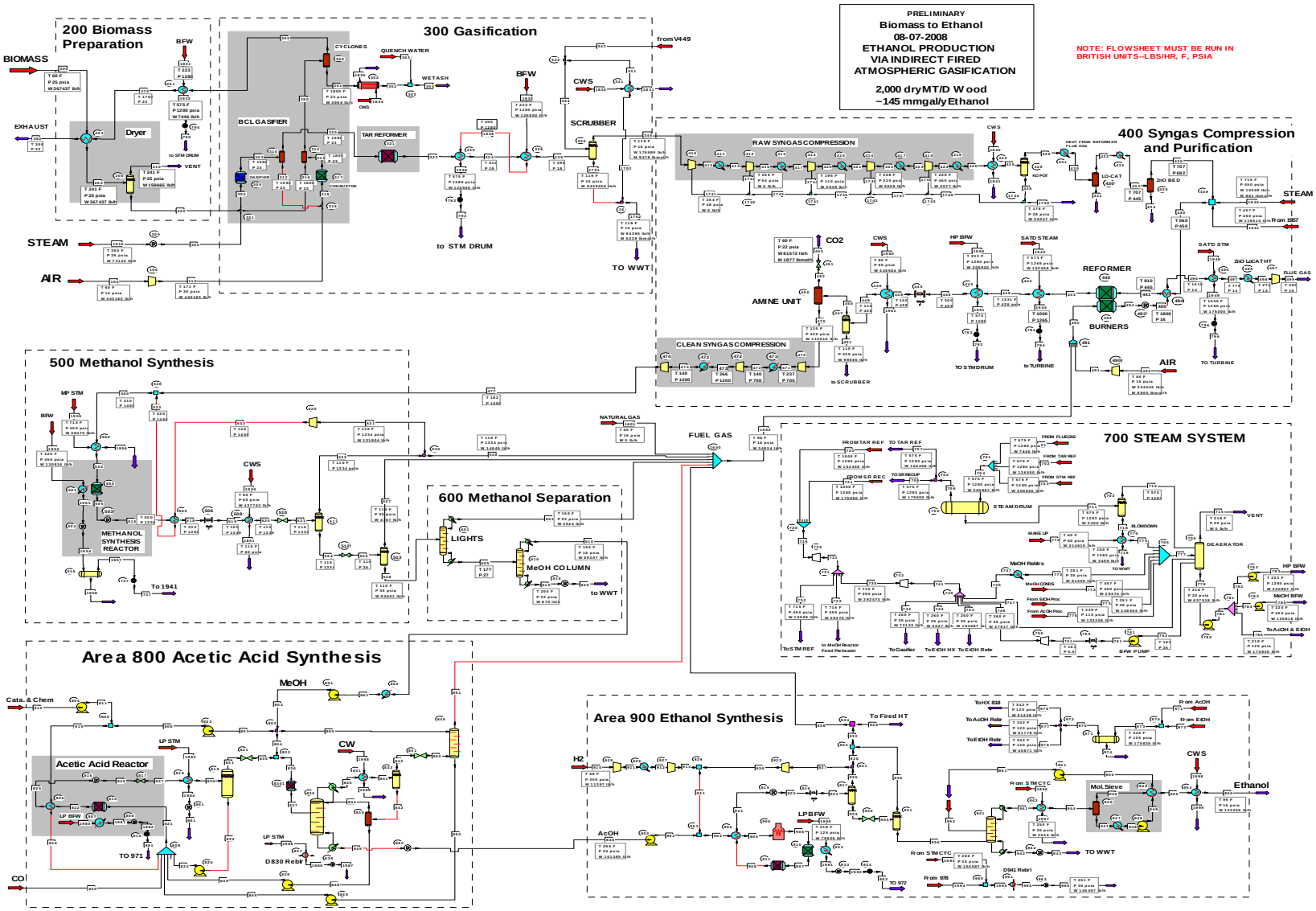

Figure A-1 Process Flow Diagram for the Indirectly-heated Gasifier Case

Table A-1 Steam Results for the Indirectly-heated Gasifier Case

Stream No.	100	110	200	202	210	220	300	302	303	312	316	318
Stream Name	AIR		BIOMASS		VENT							
Temp F	60	170.6882	60	241.1198	241.1198	241.1198	260.3139	1675.5334	1598	1598	1800	1521.1615
Pres psia	14.696	30	25	25	25	25	35	23	23	23	23	23
Enth MMBtu/h	-56.758	-40.556	-1744.9	-1549.4	-905.99	-643.42	-417.05	-9352.7	-9437	-8747.1	-8292.2	-8787.7
Vapor mole fraction	0.98568	1	0	0.86363	1	0	1	1	1	1	0	1
Total lbmol/h	15446.2246	15446.2246	10216.4678	10216.4678	8807.3691	1409.0992	4058.9507	88467.6406	98672.7578	86709.2031	82999.5859	102155.422
Total lb/h	442163	442163	367437.406	367437.406	158664.75	208772.672	73122	5268841.5	5268842	5025881.5	4986947	5468044.5
Total std L ft3/hr	8127.4806	8127.4806	9949.7892	9949.7892	2541.569	7408.2205	1171.3036	44206.7032	42291.9769	36446.5418	35627.1783	44574.0197
Total std V scfh	5861512	5861512	3876931.25	3876931.25	3342208.25	534723.06	1540285	33571580	37444204	32904290	31496568	38765800
Flowrates in lb/h												
Oxygen	100320.023	100320.023	0	0	0	0	0	0	3427.3118	3427.3118	0	103747.336
Nitrogen	327414	327414	0	0	0	0	0	0	0	0	0	327414
Argon	5584	5584	0	0	0	0	0	0	0	0	0	5584
Carbon	0	0	0	0	0	0	0	0	28194.9473	28194.9473	0	28194.9473
Hydrogen	0	0	0	0	0	0	0	0	5458.3101	2351.679	0	2351.679
Carbon Monoxide	0	0	0	0	0	0	0	0	76303.3672	0	0	0
Carbon Dioxide	218	218	0	0	0	0	0	0	36358.2422	0	0	218
Methane	0	0	0	0	0	0	0	0	15913.6416	0	0	0
Acetylene	0	0	0	0	0	0	0	0	685.7475	0	0	0
Ethylene	0	0	0	0	0	0	0	0	7877.7642	0	0	0
Ethane	0	0	0	0	0	0	0	0	566.7108	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	8627	8627	183718.703	183718.703	158664.75	25053.957	73122	98176	98176	0	0	8627
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	0	0	0	0	0	0	0	0	38.3004	0	0	0
Ammonia	0	0	0	0	0	0	0	0	1358.2247	0	0	0
HydrogenChloride	0	0	0	0	0	0	0	0	18.5296	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	4986947	4986947	4986947	4986947	4986947
Calcium Oxide	0	0	0	0	0	0	0	0	4960.4048	4960.4048	0	4960.4048
Benzene	0	0	0	0	0	0	0	0	639.3005	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	1917.9016	0	0	0
Hybrid Poplar Ch	0	0	183718.703	183718.703	0	183718.703	0	183718.703	0.0041	0.0041	0	0.0041
Sulfur Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	319	320	322	324	325	341	343	344	345	350	351	352
Stream Name	Syngas						from V449				ASH	
Temp F	1800	1598	1383	515.8085	296.018	110	110	110.0004	119.1799	1800	1800	300
Pres psia	23	23	20	19	18	15	415	15	15	23	23	23
Enth MMBtu/h	-8653.4	-689.86	-670.03	-771.73	-795.11	-63421	-253.51	-63675	-431.62	-361.17	-22.255	-23.92
Vapor mole fraction	1	1	1	1	1	3.92E-05	0	3.89E-05	1	1	0	0
Total lbmol/h	99224.75	11963.5576	13162.1797	13162.1797	13162.1797	518688	2071.5881	520760	9478.4297	16225.1592	88.458	88.458
Total lb/h	5468046.5	242960.297	242960	242960	242960	9345063	37319.6602	9382383	176588.531	481099.063	4960.4521	4960.4521
Total std L ft3/hr	44840.6283	5845.4346	6357.4395	6357.4395	6357.4395	149789.921	597.8044	150387.727	5293.1283	9213.4528	31.7958	31.7958
Total std V scfh	37653672	4539914.5	4994766	4994766	4994766	196830992	786123.44	197617136	3596861.5	6157101	33567.9	33567.9
Flowrates in lb/h												
Oxygen	9939.291	0	0	0	0	0	0	0	0	9939.291	0	0
Nitrogen	327393	0	781.9422	781.9422	781.9422	0.294	0	0.294	781.9391	327393	0	0
Argon	5584	0	0	0	0	0	0	0	0	5584	0	0
Carbon	0.0012	0	0	0	0	0	0	0	0	0.0012	0.0012	0.0012
Hydrogen	0.0007	3106.6311	6362.9536	6362.9536	6362.9536	4.5158	0	4.5158	6362.9028	0.0007	0	0
Carbon Monoxide	0	76303.3672	96358	96358	96358	70.8423	0	70.8423	96357.1406	0	0	0
Carbon Dioxide	103532.25	36358.2422	36358.2422	36358.2422	36358.2422	671.9916	0	671.9916	36350.707	103532.25	0	0
Methane	0	15913.6416	12730.9131	12730.9131	12730.9131	12.3324	0	12.3324	12730.7764	0	0	0
Acetylene	0	685.7475	342.8737	342.8737	342.8737	10.8265	0	10.8265	342.7528	0	0	0
Ethylene	0	7877.7642	3938.8821	3938.8821	3938.8821	57.5463	0	57.5463	3938.2429	0	0	0
Ethane	0	566.7108	56.6711	56.6711	56.6711	0.7071	0	0.7071	56.6632	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	29644.9102	98176	85277.5859	85277.5859	85277.5859	9333700	37319.6602	9371020	19038.5586	29644.9102	0	0
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	0	38.3004	38.3004	38.3004	38.3004	1.7024	0	1.7024	38.2814	0	0	0
Ammonia	0	1358.2247	407.4674	407.4674	407.4674	8628.6816	0	8628.6816	303.7355	0	0	0
HydrogenChloride	0	18.5296	18.5296	18.5296	18.5296	1826.6738	0	1826.6738	0	0	0	0
Silicon Dioxide	4986947	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	4960.4512	0	0	0	0	0	0	0	0	4960.4512	4960.4512	4960.4512
Benzene	0	639.3005	191.7902	191.7902	191.7902	21.7811	0	21.7811	191.5454	0	0	0
Naphthalene	0	1917.9016	95.8951	95.8951	95.8951	53.6967	0	53.6967	95.2871	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	45.3624	0	0	0	0	0	0	0	0	45.3624	0	0
Methanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	353	354	360	370	380	412	413	416	417	420	421	422
Stream Name	QUENCH W/	WET ASH			EXHAUST							
Temp F	60	200.067	1800	1750	304.7377	254.0671	140	260.4597	140	194.8874	140	207.894
Pres psia	14.7	14.7	23	23	23	28	28	54	54	109.5	109.5	220
Enth MMBtu/h	-5.1321	-29.052	-338.92	-346.28	-541.8	-421.9	-432.11	-421.46	-440.86	-408.92	-424.77	-375.7
Vapor mole fraction	0	0	1	1	1	1	0.98875	1	0.93829	1	0.92938	1
Total lbmol/h	41.632	130.0899	16136.7012	16136.7012	16136.7041	9478.4307	9478.4307	9478.4307	9478.4307	9309.8066	9309.8066	8995.793
Total lb/h	750	5710.4521	476139	476139	476139	176588.531	176588.531	176588.531	176588.531	173550.281	173550.281	167891.563
Total std L ft3/hr	12.0139	43.8097	9181.6569	9181.6569	9181.6578	5293.1288	5293.1288	5293.1288	5293.1288	5244.4554	5244.4554	5153.7941
Total std V scfh	15798.44	49366.34	6123533	6123533	6123534.5	3596861.75	3596861.75	3596861.75	3596861.75	3532872.5	3532872.5	3413711.25
Flowrates in lb/h												
Oxygen	0	0	9939.291	9939.291	9939.2891	0	0	0	0	0	0	0
Nitrogen	0	0	327393	327393	327393	781.939	781.939	781.939	781.939	781.939	781.939	781.9389
Argon	0	0	5584	5584	5584	0	0	0	0	0	0	0
Carbon	0	0.0012	0	0	0	0	0	0	0	0	0	0
Hydrogen	0	0	0.0007	0.0007	0.0007	6362.9038	6362.9038	6362.9038	6362.9038	6362.9033	6362.9033	6362.8999
Carbon Monoxide	0	0	0	0	0	96357.1563	96357.1563	96357.1563	96357.1563	96357.1484	96357.1484	96357.1328
Carbon Dioxide	0	0	103532.25	103532.25	103532.203	36350.707	36350.707	36350.707	36350.707	36349.8516	36349.8516	36346.8594
Methane	0	0	0	0	0	12730.7764	12730.7764	12730.7764	12730.7764	12730.7725	12730.7725	12730.7529
Acetylene	0	0	0	0	0	342.7528	342.7528	342.7528	342.7528	342.7513	342.7513	342.7448
Ethylene	0	0	0	0	0	3938.2417	3938.2417	3938.2417	3938.2417	3938.2378	3938.2378	3938.2217
Ethane	0	0	0	0	0	56.6632	56.6632	56.6632	56.6632	56.6632	56.6632	56.663
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	750	750	29644.9102	29644.9102	29644.9102	19038.5625	19038.5625	19038.5625	19038.5625	16001.3311	16001.3311	10346.2061
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	0	0	0	0	0	38.2814	38.2814	38.2814	38.2814	38.2772	38.2772	38.2612
Ammonia	0	0	0	0	0	303.7355	303.7355	303.7355	303.7355	303.5885	303.5885	303.0763
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	4960.4512	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	191.5454	191.5454	191.5454	191.5454	191.5426	191.5426	191.5306
Naphthalene	0	0	0	0	0	95.2871	95.2871	95.2871	95.2871	95.2853	95.2853	95.2771
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	45.3624	45.3624	45.3624	0	0	0	0	0	0	0
Methanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	423	424	425	426	428	429	430	431	432	433	434	435
Stream Name												
Temp F	140	229.1192	140	110	110	110	120	120	120	707	707	707
Pres psia	220	465	465	465	465	465	465	445	445	445	682	682
Enth MMBtu/h	-388.67	-359.07	-371.83	-374.61	-48.885	-325.8	-325.15	0	-325.13	-285.29	-0.0040038	-285.2
Vapor mole fraction	0.94925	1	0.95865	0.95487	0	1	0.99999	0	0.99999	1	1	1
Total lbmol/h	8995.793	8847.2578	8847.2578	8847.2578	399.4541	8450.9424	8450.9424	0	8450.9424	8450.9424	1.1208	8449.8213
Total lb/h	167891.563	165214.203	165214.203	165214.203	7207.1816	158060.703	158060.703	0	158060.703	158060.703	38.1916	158022.516
Total std L ft3/hr	5153.7941	5110.8911	5110.8911	5110.8911	115.5457	4996.7128	4996.7128	0	4996.7128	4996.7128	0.7743	4995.9383
Total std V scfh	3413711.25	3357345.25	3357345.25	3357345.25	151584.3	3206952	3206952	0	3206952	3206952	425.31	3206526.5
Flowrates in lb/h												
Oxygen	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen	781.9389	781.9388	781.9388	781.9388	0	781.9396	781.9396	0	781.9396	781.9396	0	781.9396
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	6362.8999	6362.895	6362.895	6362.895	0.0017	6362.9019	6362.9019	0	6362.9019	6362.9019	0	6362.9019
Carbon Monoxide	96357.1328	96357.0859	96357.0859	96357.0938	0.0114	96357.2734	96357.2734	0	96357.2734	96357.2734	0	96357.2734
Carbon Dioxide	36346.8594	36344.2422	36344.2422	36344.2383	18.9312	36324.832	36324.832	0	36324.832	36324.832	0	36324.832
Methane	12730.7529	12730.7275	12730.7275	12730.7305	0.0162	12730.7383	12730.7383	0	12730.7383	12730.7383	0	12730.7383
Acetylene	342.7448	342.7378	342.7378	342.7377	0.0094	342.7616	342.7616	0	342.7616	342.7616	0	342.7616
Ethylene	3938.2217	3938.2014	3938.2014	3938.2012	0.0124	3938.3491	3938.3491	0	3938.3491	3938.3491	0	3938.3491
Ethane	56.663	56.6627	56.6627	56.6627	0.0001	56.6648	56.6648	0	56.6648	56.6648	0	56.6648
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	10346.2061	7672.0273	7672.0273	7672.0278	7184.854	489.7838	489.7838	0	489.7838	489.7838	0	489.7838
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	38.2612	38.2458	38.2458	38.2458	0.0442	38.1916	38.1916	0	38.1916	38.1916	38.1916	0
Ammonia	303.0763	302.636	302.636	302.6361	3.2912	350.078	350.078	0	350.078	350.078	0	350.078
HydrogenChloride	0	0	0	0	0	0.0001	0.0001	0	0.0001	0.0001	0	0.0001
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	191.5306	191.5164	191.5164	191.5165	0.0074	191.6036	191.6036	0	191.6036	191.6036	0	191.6036
Naphthalene	95.2771	95.2669	95.2669	95.2669	0.0022	95.5825	95.5825	0	95.5825	95.5825	0	95.5825
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	440	441	443	445	446	448	449	450	451	452	453	470
Stream Name												
Temp F	560.4567	810	1652	1331.3323	299.9039	150	110	110	110	120	59.81	120
Pres psia	450	445	430	427.5	427.5	427.5	425	425	425	420	22	420
Enth MMBtu/h	-1048.3	-1013.2	-845.37	-896.71	-1101.3	-1166.5	-1175.4	-500.3	-675.11	-315.69	-315.69	-184.74
Vapor mole fraction	1	1	1	1	0.81552	0.68597	0.68145	1	0	0.98397	0.98969	1
Total lbmol/h	15950.4219	15950.4219	17305.8691	17305.8691	17305.8691	17305.8691	17305.8691	11793.0635	5512.8057	1877.4587	1877.4587	9915.6045
Total lb/h	293146	293146	293147	293147	293147	293147	293147	193582.109	99564.7969	81571.7109	81571.7109	112010.398
Total std L ft3/hr	7160.4089	7160.4089	8270.9056	8270.9056	8270.9056	8270.9056	8270.9056	6674.5739	1596.3321	1577.5438	1577.5438	5097.0301
Total std V scfh	6052844	6052844	6567207.5	6567207.5	6567207.5	6567207.5	6567207.5	4475215.5	2091991.88	712455.44	712455.44	3762760
Flowrates in lb/h												
Oxygen	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen	781.9396	781.9396	1052.5867	1052.5867	1052.5867	1052.5867	1052.5867	1052.5861	0.0006	0	0	1052.5861
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	6362.9019	6362.9019	12762.8584	12762.8584	12762.8584	12762.8584	12762.8584	12762.8291	0.0299	0	0	12762.8291
Carbon Monoxide	96357.2734	96357.2734	83295.1641	83295.1641	83295.1641	83295.1641	83295.1641	83295.0781	0.0886	0	0	83295.0781
Carbon Dioxide	36324.832	36324.832	90249.1328	90249.1328	90249.1328	90249.1328	90249.1328	89822.6797	426.4536	80840.4141	80840.4141	8982.2676
Methane	12730.7383	12730.7383	5897.8638	5897.8638	5897.8638	5897.8638	5897.8638	5897.7964	0.068	0	0	5897.7964
Acetylene	342.7616	342.7616	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0	0	0	0.0005
Ethylene	3938.3491	3938.3491	0.137	0.137	0.137	0.137	0.137	0.137	0	0	0	0.137
Ethane	56.6648	56.6648	0.3613	0.3613	0.3613	0.3613	0.3613	0.3613	0	0	0	0.3613
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	135613.094	135613.094	99867.7422	99867.7422	99867.7422	99867.7422	99867.7422	731.3007	99136.4375	731.3007	731.3008	0
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Ammonia	350.078	350.078	21.0044	21.0044	21.0044	21.0044	21.0044	19.3383	1.666	0	0	19.3383
HydrogenChloride	0.0001	0.0001	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	191.6036	191.6036	0	0	0	0	0	0	0	0	0	0
Naphthalene	95.5825	95.5825	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	0	0.0572	0.0572	0.0572	0.0572	0.0572	0.0041	0.0532	0	0	0.0041
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	471	472	473	474	477	490	491	492	494	495	496	497
Stream Name						AIR					To LOCAT&ZnO	
Temp F	236.7104	140	265.605	140	182.1521	60	175.9874	160.4811	1800	1800	1417.9185	779.0491
Pres psia	700	700	1200	1200	1450	14.696	25	16	16	16	14	14
Enth MMBtu/h	-176.39	-183.33	-174.19	-183.31	-180.21	-1.0619	6.0791	-68.924	-238.01	-238.01	-273.17	-328.51
Vapor mole fraction	1	1	1	1	1	1	1	1	1	1	1	1
Total lbmol/h	9915.6045	9915.6045	9915.6045	9915.6045	9915.6045	8805.4521	8805.4521	10598.2236	10207.3936	10207.3936	10207.4199	10207.4199
Total lb/h	112010.398	112010.398	112010.398	112010.398	112010.398	254045	254045	288969.063	288969	288969	288969.406	288969.406
Total std L ft3/hr	5097.0301	5097.0301	5097.0301	5097.0301	5097.0301	4703.5158	4703.5158	5845.7247	5513.4751	5513.4751	5513.4907	5513.4907
Total std V scfh	3762760	3762760	3762760	3762760	3762760	3341480.75	3341480.75	4021799.25	3873487.75	3873487.75	3873497.75	3873497.75
Flowrates in lb/h												
Oxygen	0	0	0	0	0	59170.6875	59170.6875	59170.6875	7508.6226	7508.6226	7507.5742	7507.5742
Nitrogen	1052.5861	1052.5861	1052.5861	1052.5861	1052.5861	194874.063	194874.063	195926.656	195928.328	195928.328	195928.328	195928.328
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	12762.8291	12762.8291	12762.8291	12762.8291	12762.8291	0	0	1350.307	0.0009	0.0009	0.0009	0.0009
Carbon Monoxide	83295.0781	83295.0781	83295.0781	83295.0781	83295.0781	0	0	10200.5244	0.0128	0.0128	0.0128	0.0128
Carbon Dioxide	8982.2676	8982.2676	8982.2676	8982.2676	8982.2676	0	0	7383.7295	51171	51171	51172	51172
Methane	5897.7964	5897.7964	5897.7964	5897.7964	5897.7964	0	0	6079.2783	0.0002	0.0002	0.0002	0.0002
Acetylene	0.0005	0.0005	0.0005	0.0005	0.0005	0	0	0.0005	0.0003	0.0003	0.0003	0.0003
Ethylene	0.137	0.137	0.137	0.137	0.137	0	0	0.137	0.0003	0.0003	0.0003	0.0003
Ethane	0.3613	0.3613	0.3613	0.3613	0.3613	0	0	0.3613	0.0003	0.0003	0.0003	0.0003
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	0	0	0	0	0	0	0	100.9392	32430.9551	32430.9551	32431.5938	32431.5938
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Ammonia	19.3383	19.3383	19.3383	19.3383	19.3383	0	0	19.3385	0.0002	0.0002	0.0002	0.0002
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	30.5038	30.5038	30.5016	30.5016
Methanol	0.0041	0.0041	0.0041	0.0041	0.0041	0	0	3479.3455	0.0003	0.0003	0.0003	0.0003
Ethanol	0	0	0	0	0	0	0	218.9563	0.0004	0.0004	0.0004	0.0004
N-Propanol	0	0	0	0	0	0	0	0.0933	0.0005	0.0005	0.0005	0.0005
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	28.6126	0.0008	0.0008	0.0008	0.0008
Acetic Acid	0	0	0	0	0	0	0	0.0378	0.0006	0.0006	0.0006	0.0006
Methyl Acetate	0	0	0	0	0	0	0	2902.3938	0.0007	0.0007	0.0007	0.0007
Hydrogen Iodide	0	0	0	0	0	0	0	0.0265	1899.3302	1899.3302	1899.4148	1899.4148
Methyl Iodide	0	0	0	0	0	0	0	2107.5837	0.0014	0.0014	0.0014	0.0014
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	498	499	500	502	505	515	518	519	520	521	523	524
Stream Name	FLUE GAS					GAS OUT						TO WWT
Temp F	272.0878	289.9471	310.1829	482	500	500	333.9597	150	110	109.9958	109.9958	109.9958
Pres psia	14	15	1450	1450	1350	1350	1350	1340	1335	1334	1334	1334
Enth MMBtu/h	-368.99	-367.62	-426.64	-399.29	-521.13	-521.13	-545.96	-611	-619.76	-619.76	-302.78	-316.98
Vapor mole fraction	1	1	1	1	1	1	1	0.79125	0.7806	0.78061	1	0
Total lbmol/h	10207.4199	10207.4199	19734.1543	19734.1543	13975.5137	13975.5137	13975.5137	13975.5137	13975.5137	13975.5137	10909.3662	3066.1472
Total lb/h	288969.406	288969.406	243815.563	243815.563	243816.672	243816.672	243816.672	243816.672	243816.672	243816.656	146448.547	97368.1406
Total std L ft3/hr	5513.4907	5513.4907	11205.9516	11205.9516	8760.0935	8760.0935	8760.0935	8760.0935	8760.0935	8760.0926	6787.6222	1972.4702
Total std V scfh	3873497.75	3873497.75	7488689.5	7488689.5	5303408.5	5303408.5	5303408.5	5303408.5	5303408.5	5303408.5	4139871.25	1163537.38
Flowrates in lb/h												
Oxygen	7507.5742	7507.5742	0	0	0	0	0	0	0	0	0	0
Nitrogen	195928.328	195928.297	10267.6982	10267.6982	10267.6982	10267.6982	10267.6982	10267.6982	10267.6982	10267.6982	10239.0127	28.6852
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	0.0009	0.0009	22043	22043	10338.6055	10338.6055	10338.6055	10338.6055	10338.6055	10338.6055	10311.125	27.4801
Carbon Monoxide	0.0128	0.0128	117318	117318	38003.7344	38003.7344	38003.7344	38003.7344	38003.7344	38003.7305	37801.9453	201.7849
Carbon Dioxide	51172	51172.0117	38792.3242	38792.3242	36693.8828	36693.8828	36693.8828	36693.8828	36693.8828	36693.8828	33122.1133	3571.771
Methane	0.0002	0.0002	52460.7383	52460.7383	52460.7383	52460.7383	52460.7383	52460.7383	52460.7383	52460.7344	51736.5547	724.1797
Acetylene	0.0003	0.0003	0.0026	0.0026	0.0026	0.0026	0.0026	0.0026	0.0026	0.0026	0.0023	0.0003
Ethylene	0.0003	0.0003	0.9344	0.9344	0.9344	0.9344	0.9344	0.9344	0.9344	0.9344	0.886	0.0484
Ethane	0.0003	0.0003	2.468	2.468	2.468	2.468	2.468	2.468	2.468	2.468	2.3408	0.1272
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	32431.5938	32431.5898	6.3411	6.3411	865.3136	865.3136	865.3136	865.3136	865.3136	865.3136	7.0458	858.2678
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Ammonia	0.0002	0.0002	33.3961	33.3961	33.3961	33.3961	33.3961	33.3961	33.3961	33.3961	15.6195	17.7766
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	30.5016	30.5016	0	0	0	0	0	0	0	0	0	0
Methanol	0.0003	0.0003	2890.7324	2890.7324	95150	95150	95150	95150	95150	95150	3211.8857	91938.0156
Ethanol	0.0004	0.0004	0	0	0	0	0	0	0	0	0	0
N-Propanol	0.0005	0.0005	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0.0008	0.0008	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0.0006	0.0006	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0.0007	0.0007	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	1899.4148	1899.415	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0.0014	0.0014	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	525	527	528	531	532	533	540	601	605	610	615	620
Stream Name										MeOH	to WWT	
Temp F	110.2744	110.2744	110.2744	109.9958	125.9087	420	109.9958	156.1596	177.2488	152.1098	199.7724	199.7724
Pres psia	35	35	35	1334	1450	1450	1334	23	26.7	16	22	22
Enth MMBtu/h	-316.98	-15.305	-301.68	-272.5	-271.26	-246.43	-30.278	-7.4826	-287.98	-282.62	-4.8775	-4.8775
Vapor mole fraction	0.052202	1	0	1	1	1	1	1	0	0	0	0
Total lbmol/h	3066.147	160.0576	2906.0894	9818.4287	9818.4287	9818.4287	1090.9365	74.0763	2832.0137	2790.1672	41.8459	41.8457
Total lb/h	97368.1406	4767.3594	92600.7813	131803.672	131803.672	131803.672	14644.8525	2523.9221	90076.8516	89206.8516	869.9973	869.9972
Total std L ft3/hr	1972.4702	122.8307	1849.6394	6108.8594	6108.8594	6108.8594	678.7623	50.783	1798.8564	1783.8618	14.9946	14.9946
Total std V scfh	1163537.25	60738.46	1102798.75	3725883.75	3725883.75	3725883.75	413987.09	28110.37	1074688.63	1058808.88	15879.61	15879.55
Flowrates in lb/h												
Oxygen	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen	28.6852	28.5552	0.13	9215.1113	9215.1113	9215.1113	1023.9013	0.13	0	0	0	0
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	27.4801	27.3658	0.1143	9280.0117	9280.0117	9280.0117	1031.1125	0.1143	0	0	0	0
Carbon Monoxide	201.7849	199.9819	1.803	34021.75	34021.75	34021.75	3780.1943	1.803	0	0	0	0
Carbon Dioxide	3571.771	2902.1167	669.6542	29809.9023	29809.9023	29809.9023	3312.2114	669.6542	0	0	0	0
Methane	724.1797	705.8893	18.2904	46562.8984	46562.8984	46562.8984	5173.6553	18.2904	0	0	0	0
Acetylene	0.0003	0.0002	0.0001	0.002	0.002	0.002	0.0002	0.0001	0	0	0	0
Ethylene	0.0484	0.0434	0.005	0.7974	0.7974	0.7974	0.0886	0.005	0	0	0	0
Ethane	0.1272	0.1136	0.0135	2.1067	2.1067	2.1067	0.2341	0.0135	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	858.2678	2.2634	856.0043	6.3412	6.3412	6.3412	0.7046	0	856.0043	251.3222	604.6821	604.682
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Ammonia	17.7766	4.7158	13.0608	14.0576	14.0576	14.0576	1.562	13.0606	0.0001	0.0001	0	0
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	91938.0156	896.3137	91041.7031	2890.6973	2890.6973	2890.6973	321.1886	1820.8511	89220.8438	88955.5313	265.3152	265.3152
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	701	702	703	704	706	707	708	711	712	715	718	719
Stream Name	FROM FLUE	FROM TAR F	FROM STM REF			TO TAR REF	TO SR RECUP			VENT		TO WWT
Temp F	574.747	574.747	574.747	574.7459	575	575	575	575	574.9981	218.4425	574.9981	150
Pres psia	1280	1280	1280	1280	1282.5627	1282.5627	1282.5627	1282.5627	1282.5627	19.5	1282.5627	1282.563
Enth MMBtu/h	-42.374	-719.86	-1177.5	-1939.7	-1920.4	-924.5	-995.87	-21.424	0	0	-21.424	-23.018
Vapor mole fraction	1	1	1	1	1	1	1	0	1	1	0	0
Total lbmol/h	413.3434	7021.9263	11486.0049	18921.2734	18732.0605	9017.9326	9714.1279	189.2129	0	0	189.2129	189.2129
Total lb/h	7446.3818	126500	206920.375	340867	337458.063	162458.047	175000.016	3408.6702	0	0	3408.6702	3408.6707
Total std L ft3/hr	119.2798	2026.3385	3314.551	5460.1686	5405.5671	2602.332	2803.2352	54.6017	0	0	54.6017	54.6017
Total std V scfh	156855	2664671	4358693.5	7180219	7108416.5	3422112.75	3686304	71802.25	0	0	71802.25	71802.26
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	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
Carbon Monoxide	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Methane	0	0	0	0	0	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	7446.3818	126500	206920.375	340867	337458.063	162458.047	175000.016	3408.6702	0	0	3408.6702	3408.6707
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	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
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	720	721	725	731	732	733	735	737	741	742	743	744
Stream Name	FROM TAR I	FROM SR REC			To STM REF			To 1941		To MeOH Re	To EtOH HX	To EtOH Reb
Temp F	1000	1000	999.5972	714.9084	714.9084	714.9084	714.9084	456.586	260.3119	260.3119	260.3119	260.3119
Pres psia	1265	1280	1265	450	450	450	450	450	35	35	35	35
Enth MMBtu/h	-873.03	-940.51	-1813.5	-1857	-85.347	-162.21	-1609.5	-677.79	-1674.2	-418.57	-17.442	-598.68
Vapor mole fraction	1	1	1	1	1	1	1	1	0.97786	0.97786	0.97786	0.97786
Total lbmol/h	9017.9297	9714.1279	18732.0586	18732.0586	860.8937	1636.1923	16234.9727	6639.8369	16234.9727	4058.9507	169.1368	5805.5513
Total lb/h	162458	175000.016	337458.031	337458.031	15509	29476.002	292473.031	119616.656	292473.031	73122	3047	104587
Total std L ft3/hr	2602.331	2803.2352	5405.5667	5405.5667	248.4307	472.1609	4684.9751	1916.0777	4684.9751	1171.3036	48.8083	1675.3254
Total std V scfh	3422111.5	3686304	7108416	7108416	326690.78	620900	6160825	2519676.25	6160825	1540285	64183.82	2203082.5
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	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
Carbon Monoxide	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Methane	0	0	0	0	0	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	162458	175000.016	337458.031	337458.031	15509	29476.002	292473.031	119616.656	292473.031	73122	3047	104587
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	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
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	745	746	747	751	761	762	770	772	773	774	775	776
Stream Name							MAKE UP	MeOH CONDS				
Temp F	260.3119	260.3119	260.3119	163.3197	163.3197	163.4347	60	456.584	251.3706	251.3727	67.4288	338.9405
Pres psia	35	35	35	5	5	35	60	450	30	30	60	115
Enth MMBtu/h	-465.38	-159.8	-14.311	-163.06	-188.14	-188.14	-1468.6	-189.56	-987.64	-540.68	-1467	-873.83
Vapor mole fraction	0.97786	0.97786	0.97786	0.89878	1.00E-06	0	0	0	0	8.92E-05	0	0
Total lbmol/h	4512.9063	1549.6541	138.7733	1549.6541	1549.6541	1549.6542	11913.1279	1636.1921	8243.3535	4512.9063	11913.1279	7394.1719
Total lb/h	81300	27917.0176	2500	27917.0176	27917.0176	27917.0195	214615	29476	148504.016	81300	214615	133206
Total std L ft3/hr	1302.3029	447.1883	40.0462	447.1883	447.1883	447.1884	3437.8071	472.1609	2378.8094	1302.3029	3437.8071	2133.7585
Total std V scfh	1712551.5	588060.56	52661.48	588060.56	588060.56	588060.63	4520777.5	620899.94	3128176.5	1712551.5	4520777.5	2805930.25
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	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
Carbon Monoxide	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Methane	0	0	0	0	0	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	81300	27917.0176	2500	27917.0176	27917.0176	27917.0195	214615	29476	148504.016	81300	214615	133206
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	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
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	777	779	781	782	783	784	785	786	790	792	793	794
Stream Name			BFW	HEATED BF\	HP BFW	BFW to R50(	MeOH BFW					
Temp F	217.0506	218.4425	218.8479	218.8479	223.2834	218.8479	220.1798	218.8479	574.747	574.747	574.747	1000
Pres psia	19.5	19.5	125	125	1280	125	450	125	1280	1280	1280	1265
Enth MMBtu/h	-4058.7	-4261.1	-4260.9	-2278.2	-2276.7	-807.48	-807.32	-1175.2	-42.374	-719.86	-1177.5	-873.03
Vapor mole fraction	0	0	0	0	0	0	0	0	1	1	1	1
Total lbmol/h	33699.75	35388.1758	35388.1758	18921.2871	18921.2871	6706.4116	6706.4116	9760.4775	413.3434	7021.9263	11486.0049	9017.9297
Total lb/h	607101	637518	637518	340867	340867	120816	120816	175835	7446.3818	126500	206920.375	162458
Total std L ft3/hr	9724.8386	10212.0727	10212.0727	5460.1727	5460.1727	1935.2893	1935.2893	2816.6105	119.2798	2026.3385	3314.551	2602.331
Total std V scfh	12788335	13429056	13429056	7180224	7180224	2544939.75	2544939.75	3703892.5	156855	2664671	4358693.5	3422111.5
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	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
Carbon Monoxide	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Methane	0	0	0	0	0	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	607101	637518	637518	340867	340867	120816	120816	175835	7446.3818	126500	206920.375	162458
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	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
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	796	801	802	803	804	805	806	810	811	815	816	820
Stream Name												
Temp F	1000	152.2731	152.4677	152.4677	152.4677	152.4677	155.9422	59	65.0812	155.4758	300	250
Pres psia	1280	16	40	40	40	40	470	14.7	480	470	465	470
Enth MMBtu/h	-940.51	-282.61	-282.6	-279.78	-1.413	-1.413	-279.57	-0.095611	-0.093831	-279.66	-269.62	-139.28
Vapor mole fraction	1	1.00E-08	0	0	0	0	0	0	0	0	0	1
Total lbmol/h	9714.1279	2790.1672	2790.1672	2762.2656	13.9508	13.9508	2762.2656	15	15	2777.2656	2777.2656	2943
Total lb/h	175000.016	89206.8516	89206.8516	88314.7813	446.0342	446.0342	88314.7813	2129.085	2129.085	90443.8672	90443.8672	82433.4297
Total std L ft3/hr	2803.2352	1783.8618	1783.8618	1766.0232	8.9193	8.9193	1766.0232	14.8434	14.8434	1780.8666	1780.8666	1648.9245
Total std V scfh	3686304	1058808.88	1058808.88	1048220.75	5294.04	5294.04	1048220.75	5692.18	5692.18	1053913	1053913	1116805.63
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	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
Carbon Monoxide	0	0	0	0	0	0	0	0	0	0	0	82433.4297
Carbon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Methane	0	0	0	0	0	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	175000.016	251.3222	251.3222	248.8089	1.2566	1.2566	248.8089	0	0	248.8089	248.8089	0
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Ammonia	0	0.0001	0.0001	0.0001	0	0	0.0001	0	0	0.0001	0.0001	0
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	88955.5313	88955.5313	88066	444.7776	444.7776	88066	0	0	88066	88066	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	2129.085	2129.085	2129.085	2129.085	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	821	822	825	826	827	830	831	832	833	835	836	837
Stream Name												
Temp F	205.1537	372	323.6552	323.6552	251.968	274.617	274.6186	274.6186	277.6664	275.949	272.9996	275.5423
Pres psia	465	445	440	440	40	35	35	35	470	34	34	34
Enth MMBtu/h	-727.87	-823.44	-833.48	-833.48	-833.48	-788.57	-694.9	-93.667	-93.62	-694.9	-696.31	-696.31
Vapor mole fraction	0.41421	0.069062	0.048705	0.048705	0.24277	0.9	1	0	0	1	1	1
Total lbmol/h	7907.1543	5197.4004	5197.4004	5197.4004	5197.4004	5197.4004	4677.6626	519.7379	519.784	4677.6626	4691.6138	4691.6128
Total lb/h	271943.125	271946	271946	271946	271946	271946	243095	28850.8613	28853.8398	243095	243541.016	243541.016
Total std L ft3/hr	4878.2697	4101.1535	4101.1535	4101.1535	4101.1539	4101.1539	3662.4358	438.7179	438.7638	3662.4358	3671.3551	3670.9192
Total std V scfh	3000596	1972302.38	1972302.38	1972302.38	1972302.38	1972302.38	1775073	197229.42	197246.92	1775073	1780367.13	1780366.75
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	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
Carbon Monoxide	82435.0547	6218.1631	6218.1631	6218.1631	6218.1626	6218.1626	6217.5371	0.6258	0.6261	6217.5371	6217.5371	6217.5371
Carbon Dioxide	2.8782	500.4657	500.4657	500.4657	500.4657	500.4657	500.001	0.4647	0.4649	500.001	500.001	500.001
Methane	0.0662	181.4521	181.4521	181.4521	181.4521	181.4521	181.4317	0.0204	0.0204	181.4317	181.4317	181.4317
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	20491.8652	20963.6113	20963.6113	20963.6113	20963.6113	20963.6113	19825.3594	1138.2534	1138.2079	19825.3594	19826.6152	20100.5977
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Ammonia	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0	0	0.0002	0.0002	0.0002
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	88075.2109	47.9428	47.9428	47.9428	47.9428	47.9428	46.7325	1.2103	1.2102	46.7325	491.5102	4.1966
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	31878.1113	192899.734	192899.734	192899.734	192899.734	192899.734	166282.578	26617.1582	26619.6719	166282.578	166282.578	165504
Methyl Acetate	31147.3809	33142.5078	33142.5078	33142.5078	33142.5117	33142.5117	32327.377	815.1332	815.625	32327.377	32327.377	33287.9063
Hydrogen Iodide	103.1249	389.9552	389.9552	389.9552	389.9552	389.9552	286.8489	103.1063	103.1086	286.8489	286.8489	0.0287
Methyl Iodide	17775.1602	17456.875	17456.875	17456.875	17456.875	17456.875	17314.9473	141.9273	141.9439	17314.9473	17314.9473	17633.2207
Propionic Acid	34.2884	145.129	145.129	145.129	145.129	145.129	112.1669	32.9621	32.9607	112.1669	112.1669	112.1669

Stream No.	840	841	842	843	844	845	846	848	849	850	851	852
Stream Name							AcOH					
Temp F	235.5005	100	100	100	100	295.631	295.631	100	103.0722	99.7934	86.9771	90.4266
Pres psia	29	29	29	29	29	34	34	29	470	28	27	28
Enth MMBtu/h	-686.36	-817.49	-796.61	-20.881	-572.26	-510.32	-510.31	-224.32	-224.2	-20.881	-21.15	-1.1521
Vapor mole fraction	1	0.041964	0	1	5.54E-06	0	0	0	0	1	1	0
Total lbmol/h	7416.5854	7416.5854	7105.3555	311.231	5447.8491	2722.8762	2722.7864	1657.093	1657.093	311.231	315.2786	10.0118
Total lb/h	313458.094	313458.094	300964	12494.3369	231308	161390.719	161385.391	69666.875	69666.875	12494.3369	12399.9805	545.1414
Total std L ft3/hr	3691.3806	3691.3806	3476.5643	214.8164	2473.4593	2452.9979	2452.9168	1003.2793	1003.2793	214.8164	217.3806	6.4354
Total std V scfh	2814435.75	2814435.75	2696330.5	118105.52	2067342.25	1033273.31	1033239.25	628831.38	628831.38	118105.52	119641.48	3799.26
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	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
Carbon Monoxide	6221.5117	6221.5117	4.9685	6216.5439	3.9748	0	0	0.9937	0.9937	6216.5439	6218.501	0.0091
Carbon Dioxide	509.5569	509.5569	11.9447	497.6122	9.5559	0	0	2.389	2.389	497.6122	497.7452	0.0243
Methane	181.613	181.613	0.2266	181.3864	0.1813	0	0	0.0453	0.0453	181.3864	181.4433	0.0004
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	95175	95175	95021.5313	153.3914	76006.75	932.4356	932.4022	19001.6875	19001.6875	153.3914	51.5346	103.1639
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Ammonia	0.0007	0.0007	0.0006	0.0001	0.0004	0	0	0.0001	0.0001	0.0001	0.0001	0
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	20.0262	20.0262	19.7994	0.2268	15.8394	0.0098	0.0098	3.9599	3.9599	0.2268	440.9378	4.0667
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	10513.209	10513.209	10510.6289	2.5803	5255.8657	160246.578	160241.281	5255.8657	5255.8657	2.5803	0.0002	2.5807
Methyl Acetate	46141.5352	46141.5352	43078.4688	3063.0669	12929.7568	76.1271	76.1771	30169.4297	30169.4297	3063.0669	2902.3804	162.3299
Hydrogen Iodide	0.0933	0.0933	0.0808	0.0125	0.0646	0	0	0.0162	0.0162	0.0125	0.0124	0.0002
Methyl Iodide	154689	154689	152309.484	2379.5146	137080.5	24.7122	24.7166	15231.167	15231.167	2379.5146	2107.4258	272.9641
Propionic Acid	6.6181	6.6181	6.6161	0.0021	5.3024	110.8511	110.8093	1.3256	1.3256	0.0021	0	0.0021

Stream No.	855	861	902	904	905	906	907	908	910	911	912	914
Stream Name												
Temp F	93.8057	338.574	301.3604	227.0038	361.4448	482	482	482	59	160.9383	150	287.4999
Pres psia	470	115	890	890	885	880	870	870	300	500	498	890
Enth MMBtu/h	-1.1514	-337.06	-509.7	-521.95	-469.23	-443.72	-523.23	-523.28	-2.2739	1.6665	1.2417	6.6039
Vapor mole fraction	0	1.00E-06	0	0.89064	1	1	1	1	1	1	1	1
Total lbmol/h	10.0118	2854.9624	2722.7864	24062.498	24062.498	24062.498	21445.6426	21444.1504	5604	5604	5604	5604
Total lb/h	545.1414	51432.1445	161385.375	212176.266	212176.266	212176.266	212174.641	212174.641	11296.543	11296.543	11296.543	11296.543
Total std L ft3/hr	6.4354	823.8651	2452.9166	12356.985	12356.985	12356.985	10735.5302	10734.5853	2585.0503	2585.0503	2585.0503	2585.0503
Total std V scfh	3799.26	1083397.25	1033239.25	9131204	9131204	9131204	8138163	8137596.5	2126598.25	2126598.25	2126598.25	2126598.25
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	0	0	0	42591.1406	42591.1406	42591.1406	32040.7715	32034.748	11296.543	11296.543	11296.543	11296.543
Carbon Monoxide	0.0091	0	0	4.5458	4.5458	4.5458	4.6592	4.6592	0	0	0	0
Carbon Dioxide	0.0243	0	0	102.074	102.074	102.074	107.271	107.271	0	0	0	0
Methane	0.0004	0	0	0	0	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	103.1639	51432.1445	932.4024	2158.0618	2158.0618	2158.0618	50154.7734	50181.6953	0	0	0	0
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	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
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	4.0667	0	0.0098	0.9908	0.9908	0.9908	27.1705	27.1705	0	0	0	0
Ethanol	0	0	0	6044.4277	6044.4277	6044.4277	124390.094	124390.094	0	0	0	0
N-Propanol	0	0	0	2.5153	2.5153	2.5153	2.5153	92.3191	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	804.3959	804.3959	804.3959	5056.2529	5056.2529	0	0	0	0
Acetic Acid	2.5807	0	160241.266	160244	160244	160244	241.6987	241.6987	0	0	0	0
Methyl Acetate	162.3299	0	76.1771	76.6101	76.6101	76.6101	1.9391	1.9391	0	0	0	0
Hydrogen Iodide	0.0002	0	0	0	0	0	0.6957	0.6957	0	0	0	0
Methyl Iodide	272.9641	0	24.7166	36.7593	36.7593	36.7593	35.9805	35.9805	0	0	0	0
Propionic Acid	0.0021	0	110.8093	110.8099	110.8099	110.8099	110.8099	0.1108	0	0	0	0

Stream No.	921	922	923	925	926	927	928	929	930	931	932	933
Stream Name								To Fired HT				
Temp F	307.0038	307.0038	150	150	150	150	144.1056	144.1056	161.5769	194.3622	144.1056	150
Pres psia	865	865	860	860	860	860	35	35	890	890	35	860
Enth MMBtu/h	-576.1	-576.1	-661.69	-20.081	-0.40161	-19.679	-0.78781	-1.2066	-18.85	-12.246	-1.9944	-641.61
Vapor mole fraction	0.92887	0.92887	0.74874	1	1	1	1	1	1	1	1	0
Total lbmol/h	21442.4199	21442.4199	21442.4199	16054.8975	321.0979	15733.7969	152.4215	233.4557	15733.7969	21337.7969	385.8772	5387.5229
Total lb/h	212196.484	212196.484	212196.484	40295.6719	805.9136	39489.7656	588.1381	900.8191	39489.7656	50786.3125	1488.9572	171900.781
Total std L ft3/hr	10733.9136	10733.9136	10733.9136	7467.4797	149.3496	7318.1304	72.453	110.9724	7318.1304	9903.1802	183.4254	3266.4334
Total std V scfh	8136940	8136940	8136940	6092490.5	121849.79	5970639.5	57840.71	88591.47	5970639.5	8097238	146432.14	2044449.75
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	32029.6074	32029.6074	32029.6074	31929.3711	638.5874	31290.7832	291.7143	446.8029	31290.7832	42587.3281	738.5173	100.2362
Carbon Monoxide	4.6604	4.6604	4.6604	4.6396	0.0928	4.5469	0.0448	0.0687	4.5469	4.5469	0.1135	0.0208
Carbon Dioxide	107.3304	107.3304	107.3304	104.2073	2.0841	102.1232	2.0022	3.0667	102.1232	102.1232	5.0689	3.1231
Methane	0	0	0	0	0	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	50189.3906	50189.3906	50189.3906	1250.5231	25.0105	1225.5126	46.4366	71.1244	1225.5126	1225.5126	117.561	48938.8633
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	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
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	27.1744	27.1744	27.1744	1.0009	0.02	0.9809	0.0546	0.0836	0.9809	0.9809	0.1382	26.1735
Ethanol	124406.773	124406.773	124406.773	6166.9834	123.3397	6043.644	218.9563	335.3634	6043.644	6043.644	554.3196	118239.781
N-Propanol	92.3273	92.3273	92.3273	2.5657	0.0513	2.5143	0.0933	0.1429	2.5143	2.5143	0.2362	89.7616
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	5058.6499	5058.6499	5058.6499	820.9644	16.4193	804.5451	28.6126	43.8243	804.5451	804.5451	72.4369	4237.6855
Acetic Acid	241.8202	241.8202	241.8202	2.6933	0.0539	2.6394	0.0376	0.0576	2.6394	2.6394	0.0952	239.1269
Methyl Acetate	1.94	1.94	1.94	0.4419	0.0088	0.4331	0.0136	0.0208	0.4331	0.4331	0.0343	1.4981
Hydrogen Iodide	0.696	0.696	0.696	0	0	0	0.0141	0.0216	0	0	0.0357	0.696
Methyl Iodide	35.9961	35.9961	35.9961	12.2865	0.2457	12.0408	0.1581	0.2421	12.0408	12.0408	0.4002	23.7096
Propionic Acid	0.1108	0.1108	0.1108	0.0006	0	0.0006	0	0	0.0006	0.0006	0	0.1102

Stream No.	934	935	936	941	942	943	944	946	947	948	949	950
Stream Name						TO WWT						
Temp F	148.5152	148.4762	148.4762	198.5224	250.4294	250.4294	240.4	240.4	240.4	100	100.0184	169.7795
Pres psia	35	35	35	25	30	30	23	23	23	18	21	18.5
Enth MMBtu/h	-641.61	-1.5928	-640.02	-407.96	-317.95	-317.95	-405.16	-267.67	-137.49	-164.43	-164.43	-162.32
Vapor mole fraction	0.011691	1	0	1	0	0	1	1	1	0	0	0
Total lbmol/h	5387.5225	64.7793	5322.7446	4026.5078	2654	2654.0024	4026.51	2668.6936	1357.8147	1357.8147	1357.8147	1357.8147
Total lb/h	171900.781	683.0436	171217.719	161007.313	47979.2734	47979.2969	161007.391	123236.102	37771.2148	37771.2148	37771.2148	37771.2148
Total std L ft3/hr	3266.4332	34.0758	3232.3573	3158.5513	768.3582	768.3586	3158.5526	2463.9511	694.5999	694.5999	694.5999	694.5999
Total std V scfh	2044449.63	24582.37	2019867.75	1527973.63	1007136.25	1007137.19	1527974.5	1012712.19	515261.66	515261.66	515261.66	515261.66
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	100.2362	99.9299	0.3063	0.3063	0	0	0.3063	0.3063	0	0	0	0
Carbon Monoxide	0.0208	0.0207	0.0001	0.0001	0	0	0.0001	0.0001	0	0	0	0
Carbon Dioxide	3.1231	2.9848	0.1383	0.1383	0	0	0.1383	0.1383	0	0	0	0
Methane	0	0	0	0	0	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	48938.8633	92.5506	48846.3164	17020.1504	47740.0781	47740.1016	17020.1504	1106.3094	15913.8408	15913.8408	15913.8408	15913.8408
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	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
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	26.1735	0.1182	26.0554	26.0554	0	0	26.0554	26.0554	0	0	0	0
Ethanol	118239.766	430.9799	117808.781	139663.734	0.0001	0.0001	139663.797	117806.352	21857.373	21857.373	21857.373	21857.373
N-Propanol	89.7616	0.1849	89.5767	89.5767	0	0	89.5767	89.5767	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	4237.6855	56.0176	4181.668	4181.668	0	0	4181.668	4181.668	0	0	0	0
Acetic Acid	239.1269	0.0414	239.0855	0	239.0855	239.0857	0	0	0	0	0	0
Methyl Acetate	1.4981	0.0255	1.4726	1.4726	0	0	1.4726	1.4726	0	0	0	0
Hydrogen Iodide	0.696	0.0357	0.6603	0.6603	0	0	0.6603	0.6603	0	0	0	0
Methyl Iodide	23.7096	0.1545	23.5551	23.5548	0.0003	0.0003	23.5548	23.5548	0	0	0	0
Propionic Acid	0.1102	0	0.1102	0	0.1102	0.1102	0	0	0	0	0	0

Stream No.	951	952	955	960	971	972	973	974	975	976	977	978
Stream Name				Ethanol	From AcOH	From EtOH				To HX 818	To AcOH Ret	To EtOH Reb
Temp F	169.8746	164.45	197.06	98.6	342.1166	342.1166	342.1166	342.1165	342.1165	342.1165	342.1165	342.1165
Pres psia	35	35	21	16	120	120	120	120	120	120	120	120
Enth MMBtu/h	-162.32	-162.48	-269.78	-321.08	-545.57	-454.75	-1000.3	-11.528	-988.8	-292.12	-464.52	-232.16
Vapor mole fraction	0	0	1	0	0.99	0.99	0.99	0	1	1	1	1
Total lbmol/h	1357.8147	1357.766	2668.6936	2668.6936	5323.3442	4437.1348	9760.4785	97.6007	9662.8779	2854.7229	4539.4395	2268.7156
Total lb/h	37771.2148	37768.8555	123236.102	123236.086	95900.0469	79935	175835.016	1758.2772	174076.734	51427.832	81778	40870.9102
Total std L ft3/hr	694.5999	694.5522	2463.9511	2463.9509	1536.1735	1280.4373	2816.6107	28.1649	2788.4457	823.796	1309.9597	654.6901
Total std V scfh	515261.66	515243.16	1012712.19	1012712.19	2020095.38	1683797.75	3703893	37037.39	3666855.5	1083306.38	1722620.25	860929.06
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	0	0	0.3063	0.3063	0	0	0	0	0	0	0	0
Carbon Monoxide	0	0	0.0001	0.0001	0	0	0	0	0	0	0	0
Carbon Dioxide	0	0	0.1383	0.1383	0	0	0	0	0	0	0	0
Methane	0	0	0	0	0	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	15913.8408	15913.9121	1106.3094	1106.3096	95900.0469	79935	175835.016	1758.2772	174076.734	51427.832	81778	40870.9102
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	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
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	0	26.0554	26.0554	0	0	0	0	0	0	0	0
Ethanol	21857.373	21854.9453	117806.352	117806.344	0	0	0	0	0	0	0	0
N-Propanol	0	0	89.5767	89.5767	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	4181.668	4181.6694	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	1.4726	1.4726	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0.6603	0.6603	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	23.5548	23.5548	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	981	982	985	986	1601	1602	1701	1702	1703	1741	1742	1743
Stream Name		TO 972			NATURAL G	FUEL GAS	TO WWT					
Temp F	345.1873	342.1165	251.3727	251.3727	60	95.5846	119.1799	119.1799	119.1799	254.0671	260.4597	0
Pres psia	125	120	30	30	16	16	15	15	15	28	54	0
Enth MMBtu/h	-545.5	-454.75	-967.36	-967.36	0	-75.003	-63975	-639.75	-63335	0	0	0
Vapor mole fraction	0.99001	0.99002	0.0001	0.0001	1	1	0	0	0	0	0	0
Total lbmol/h	5323.3442	4437.1348	8074.2095	8074.2095	0	1792.7706	523927.219	5239.272	518688	0	0	0
Total lb/h	95900.0469	79935	145457	145457	0	34924.2539	9439456	94394.5469	9345063	0	0	0
Total std L ft3/hr	1536.1735	1280.4373	2329.9989	2329.9989	0	1142.2095	151302.963	1513.0294	149789.921	0	0	0
Total std V scfh	2020095.38	1683797.75	3063990	3063990	0	680318.13	198819184	1988191.75	196830992	0	0	0
Flowrates in lb/h												
Oxygen	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen	0	0	0	0	0	1052.5864	0.297	0.003	0.294	0	0	0
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	1350.307	4.5614	0.0456	4.5158	0	0	0
Carbon Monoxide	0	0	0	0	0	10200.5244	71.5579	0.7156	70.8423	0	0	0
Carbon Dioxide	0	0	0	0	0	7383.7295	678.7794	6.7878	671.9916	0	0	0
Methane	0	0	0	0	0	6079.2783	12.457	0.1246	12.3324	0	0	0
Acetylene	0	0	0	0	0	0.0005	10.9358	0.1094	10.8265	0	0	0
Ethylene	0	0	0	0	0	0.137	58.1276	0.5813	57.5463	0	0	0
Ethane	0	0	0	0	0	0.3613	0.7142	0.0071	0.7071	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	95900.0469	79935	145457	145457	0	100.9392	9427980	94279.7891	9333700	0	0	0
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	0	0	0	0	0	0	1.7196	0.0172	1.7024	0	0	0
Ammonia	0	0	0	0	0	19.3385	8715.8398	87.1584	8628.6816	0	0	0
HydrogenChloride	0	0	0	0	0	0	1845.1251	18.4513	1826.6738	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	22.0011	0.22	21.7811	0	0	0
Naphthalene	0	0	0	0	0	0	54.2391	0.5424	53.6967	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	0	0	0	0	3479.3455	0	0	0	0	0	0
Ethanol	0	0	0	0	0	218.9563	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0.0933	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	28.6126	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0.0378	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	2902.3938	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0.0265	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	2107.5837	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	1744	1745	1746	1747	1748	1749	1750	1830	1831	1834	1835	1840
Stream Name				TO WWT		to WWT	TO DEAREA	CWS		CWS		CWS
Temp F	194.8874	194.8875	207.894	203.3286	229.1192	209.4038	178.4724	90	110	90	110	90
Pres psia	109.5	109.5	220	109.5	465	109.5	28	60	60	60	60	65
Enth MMBtu/h	-20.377	-20.377	-37.871	-58.247	-17.856	-76.103	-243.62	-29228	-29142	-566.97	-565.3	-946.43
Vapor mole fraction	0	0	0	5.26E-06	0	1.45E-05	0.00012226	0	0	0	0	0
Total lbmol/h	168.624	168.624	314.0154	482.6394	148.5343	631.1736	2011.1404	238140.484	238140.469	4619.5381	4619.5376	7711.2808
Total lb/h	3038.259	3038.259	5658.7344	8697	2677.3687	11374.3604	36247.457	4290100.5	4290100.5	83221	83221	138918.719
Total std L ft3/hr	48.6731	48.6731	90.6616	139.3348	42.9033	182.2381	580.7869	68720.915	68720.915	1333.074	1333.0739	2225.2676
Total std V scfh	63989.19	63989.19	119162.13	183151.34	56365.58	239516.91	763184.81	90369224	90369216	1753016	1753015.75	2926266.25
Flowrates in lb/h												
Oxygen	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen	0	0	0	0	0	0.0001	0.0002	0	0	0	0	0
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	0.0007	0.0007	0.0035	0.0043	0.005	0.0093	0.0135	0	0	0	0	0
Carbon Monoxide	0.0048	0.0048	0.0229	0.0278	0.0321	0.0598	0.0881	0	0	0	0	0
Carbon Dioxide	0.8535	0.8535	2.99	3.8434	2.6136	6.457	28.8103	0	0	0	0	0
Methane	0.0044	0.0044	0.0193	0.0237	0.0238	0.0475	0.0796	0	0	0	0	0
Acetylene	0.0016	0.0016	0.0064	0.008	0.007	0.015	0.0303	0	0	0	0	0
Ethylene	0.0038	0.0038	0.0165	0.0202	0.0202	0.0405	0.0664	0	0	0	0	0
Ethane	0	0	0.0002	0.0003	0.0003	0.0005	0.0008	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	3037.2344	3037.2344	5655.1265	8692.3613	2674.1868	11366.5469	36212.9336	4290100.5	4290100.5	83221	83221	138918.719
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	0.0042	0.0042	0.0159	0.0201	0.0155	0.0356	0.0961	0	0	0	0	0
Ammonia	0.147	0.147	0.5122	0.6592	0.4403	1.0995	5.263	0	0	0	0	0
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0.0028	0.0028	0.0121	0.0149	0.0141	0.029	0.0466	0	0	0	0	0
Naphthalene	0.0018	0.0018	0.0082	0.01	0.0102	0.0202	0.0288	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	1841	1850	1851	1910	1931	1932	1935	1936	1938	1940	1941	1943
Stream Name		CWS		STEAM	BFW	to STM DRU	BFW	MP STEAM	to STM DRU	STEAM	From 1957	
Temp F	110	90	110	260.3139	223	574.747	223	400	574.747	715.0002	456.5881	573.2465
Pres psia	65	65	60	35	1280	1280	1280	1280	1280	450	450	1265
Enth MMBtu/h	-943.65	-2982.4	-2973.6	-417.05	-49.737	-42.374	-844.94	-821.55	-719.86	-85.348	-677.77	-924.37
Vapor mole fraction	0	0	0	1	0	1	0	0	1	1	1	1
Total lbmol/h	7711.2808	24299.8965	24299.8945	4058.9507	413.3434	413.3434	7021.9263	7021.9263	7021.9263	860.9171	6639.6836	9017.9297
Total lb/h	138918.719	437763	437763	73122	7446.3818	7446.3818	126500	126500	126500	15509.4199	119614	162458
Total std L ft3/hr	2225.2676	7012.2941	7012.2937	1171.3036	119.2798	119.2798	2026.3385	2026.3385	2026.3385	248.4374	1916.0335	2602.331
Total std V scfh	2926266.25	9221291	9221291	1540285	156855	156855	2664671	2664671	2664671	326699.63	2519618	3422111.5
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	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
Carbon Monoxide	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Methane	0	0	0	0	0	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	138918.719	437763	437763	73122	7446.3818	7446.3818	126500	126500	126500	15509.4199	119614	162458
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	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
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	1944	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958
Stream Name		SAT'D STM	TO TURBINE	HP BFW		BFW			MP STM			
Temp F	1000	574.747	1000	223	574.747	220	456.586	456.586	715	456.586	456.586	456.586
Pres psia	1265	1280	1280	1280	1280	450	450	450	450	450	450	450
Enth MMBtu/h	-873.03	-995.85	-940.51	-1382.1	-1177.5	-807.34	-685.5	-685.5	-162.2	-189.55	-677.79	-7.7123
Vapor mole fraction	1	1	1	0	1	0	0.99007	0.99007	1	1.00E-07	1	0
Total lbmol/h	9017.9297	9714.1279	9714.1279	11486.0049	11486.0049	6706.4063	6706.4063	6706.4063	1636.1401	1636.1401	6639.8369	66.5694
Total lb/h	162458	175000.016	175000.016	206920.375	206920.375	120816	120816	120816	29475.0645	29475.0645	119616.656	1199.2468
Total std L ft3/hr	2602.331	2803.2352	2803.2352	3314.551	3314.551	1935.2877	1935.2877	1935.2877	472.1459	472.1459	1916.0777	19.2101
Total std V scfh	3422111.5	3686304	3686304	4358693.5	4358693.5	2544937.75	2544937.75	2544937.75	620880.19	620880.19	2519676.25	25261.65
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	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
Carbon Monoxide	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Methane	0	0	0	0	0	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	162458	175000.016	175000.016	206920.375	206920.375	120816	120816	120816	29475.0645	29475.0645	119616.656	1199.2468
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	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
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	1960	1961	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Stream Name									From STM CYC			
Temp F	90	110	218	345.1873	345.1873	342.1186	338.574	342.1186	338.9426	338.9426	80	100
Pres psia	65	65	125	125	125	120	115	120	115	115	45	40
Enth MMBtu/h	-3041.9	-3033	-641.03	-545.5	-545.5	-292.15	-337.06	-464.53	-536.34	-536.34	-32220	-32088
Vapor mole fraction	0	0	0	0.99001	0.99001	1	1.00E-06	1	0.0019993	0.0019993	0	0
Total lbmol/h	24785.0996	24785.0996	5323.3442	5323.3442	5323.3442	2854.9624	2854.9624	4539.562	4539.562	4539.562	262134	262134
Total lb/h	446504	446504	95900.0469	95900.0469	95900.0469	51432.1445	51432.1445	81780.2031	81780.2031	81780.2031	4722341	4722340.5
Total std L ft3/hr	7152.3105	7152.3105	1536.1735	1536.1735	1536.1735	823.8651	823.8651	1309.9951	1309.9951	1309.9951	75644.7483	75644.741
Total std V scfh	9405415	9405415	2020095.38	2020095.38	2020095.38	1083397.25	1083397.25	1722666.75	1722666.75	1722666.75	99474184	99474176
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	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
Carbon Monoxide	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Methane	0	0	0	0	0	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	446504	446504	95900.0469	95900.0469	95900.0469	51432.1445	51432.1445	81780.2031	81780.2031	81780.2031	4722341	4722340.5
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	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
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Stream Name				From STM C	From 978		From STM CYC			
Temp F	218	342.1165	342.1165	260.3119	342.1186	260.3119	260.3119	250.4211	82.4	98.6
Pres psia	125	120	120	35	120	35	35	30	59.9594	59.9594
Enth MMBtu/h	-534.32	-454.75	-454.75	-598.68	-232.15	-830.83	-17.439	-20.24	-21636	-21560
Vapor mole fraction	0	0.99002	0.99002	0.9779	1	0.99108	0.9778	1.00E-08	0	0
Total lbmol/h	4437.1348	4437.1348	4437.1348	5805.5444	2268.665	8074.2095	169.103	169.103	176089.453	176089.438
Total lb/h	79935	79935	79935	104586.883	40870	145457	3046.3896	3046.3896	3172251.5	3172251
Total std L ft3/hr	1280.4373	1280.4373	1280.4373	1675.3235	654.6755	2329.9989	48.7985	48.7985	50814.6614	50814.6578
Total std V scfh	1683797.75	1683797.75	1683797.75	2203080	860909.88	3063990	64170.96	64170.96	66822184	66822176
Flowrates in lb/h										
Oxygen	0	0	0	0	0	0	0	0	0	0
Nitrogen	0	0	0	0	0	0	0	0	0	0
Argon	0	0	0	0	0	0	0	0	0	0
Carbon	0	0	0	0	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0	0	0	0	0
Carbon Monoxide	0	0	0	0	0	0	0	0	0	0
Carbon Dioxide	0	0	0	0	0	0	0	0	0	0
Methane	0	0	0	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0
Water	79935	79935	79935	104586.883	40870	145457	3046.3896	3046.3896	3172251.5	3172251
Sulphur	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	0	0	0	0	0	0	0	0	0	0
Ammonia	0	0	0	0	0	0	0	0	0	0
HydrogenChloride	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	0	0	0	0	0	0	0	0	0	0
Sulfur Dioxide	0	0	0	0	0	0	0	0	0	0
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0
Methanol	0	0	0	0	0	0	0	0	0	0
Ethanol	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0

Appendix B. Heat and Material Balance for the Directly-heated Gasifier Case

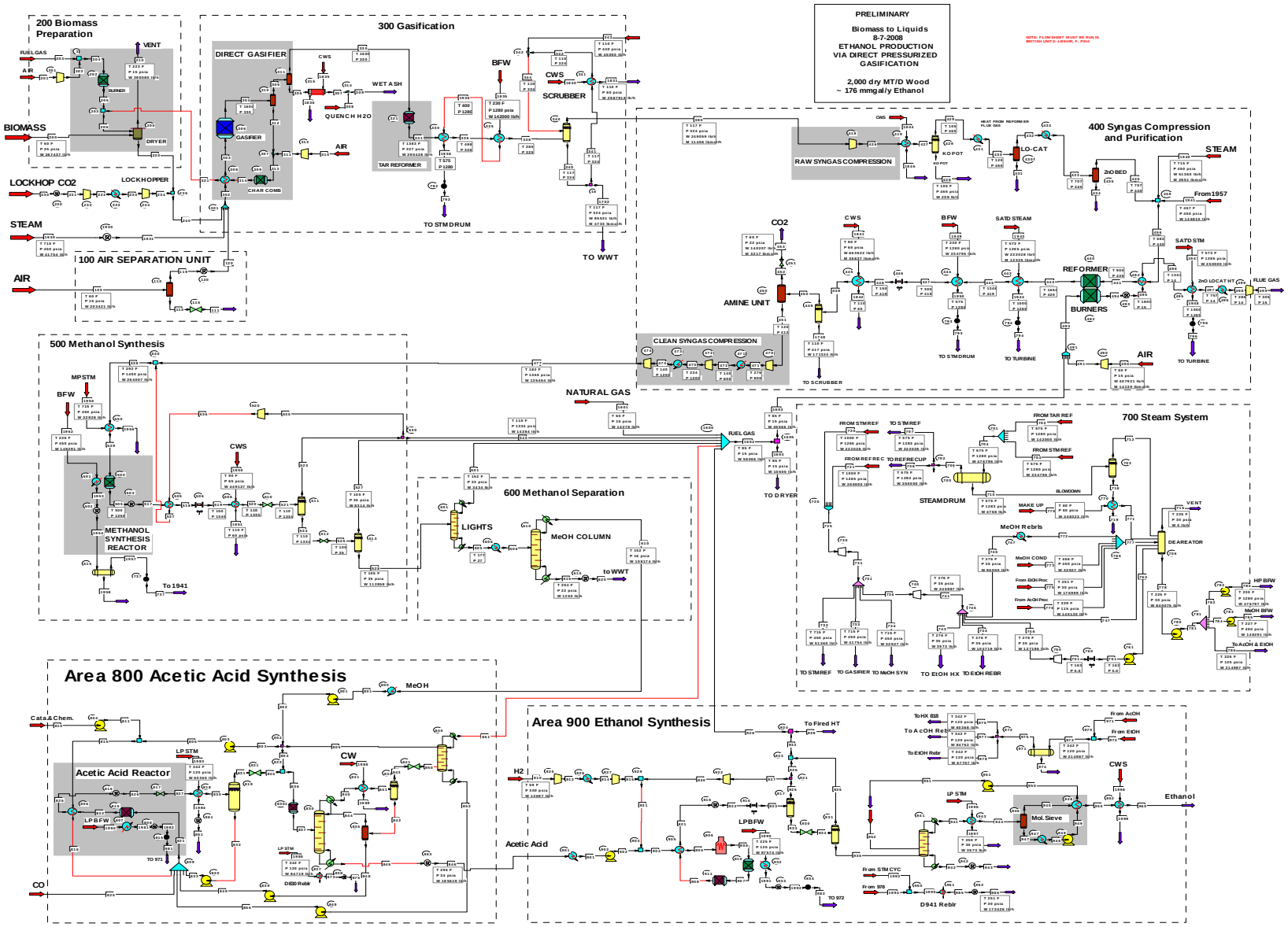

Figure B-1 Process Flow Diagram for the Directly-heated Gasifier Case

Table B-1 Steam Results for the Directly-heated Gasifier Case

Stream No.	100	110	111	119	120	200	201	202	203	204	205	206
Stream Name	AIR					BIOMASS	AIR		FUEL GAS			
Temp F	60	60	43.232	60	60	60	60	73.5309	84.5276	69.8365	3244.0483	2925.2782
Pres psia	14.696	350	25	350	350	25	14.696	17	15	15	15	15
Enth MMBtu/h	-26.112	-28.339	-28.339	-0.27723	-0.27723	-1744.9	-12.58	-11.824	-23.83	-35.654	-35.654	-71.989
Vapor mole fraction	0.98568	0.96186	0.96626	1	1	0	0.98568	0.99223	1	0.99527	1	1
Total lbmol/h	7106.1719	5658.2666	5658.2666	1447.9053	1447.9053	10216.4678	3423.4661	3423.4658	518.1594	3941.625	3866.9197	8124.5352
Total lb/h	203421	157070.578	157070.578	46350.4063	46350.4063	367437.406	98000	98000	10500	108500	108499.828	231413.297
Total std L gpd	671293.326	553034.782	553034.782	118258.544	118258.544	1786310.33	323401.941	323401.92	65624.8498	389026.755	369852.976	796702.903
Total std V scfh	2696640.25	2147191.25	2147191.25	549449.13	549449.13	3876931.25	1299132.25	1299132.13	196630.41	1495762.38	1467413.38	3083087.5
Flowrates in lb/h												
Oxygen	46153.1094	39.6902	39.6902	46113.4219	46113.4219	0	22234.6992	22234.6973	0	22234.6973	3004.4543	6579.4609
Nitrogen	150629.688	150546.844	150546.844	82.8463	82.8463	0	72567.2813	72567.2813	165.8749	72733.1563	72665.0938	160849
Argon	2568.9688	2414.8306	2414.8306	154.1381	154.1381	0	1237.625	1237.625	28.8566	1266.4816	1266.4816	1266.4816
Carbon	0	0	0	0	0	0	0	0	0	0	0	0.0002
Hydrogen	0	0	0	0	0	0	0	0	257.6364	257.6364	0.4169	11.6106
Carbon Monoxide	0	0	0	0	0	0	0	0	2238.6155	2238.6155	12.225	1065.4545
Carbon Dioxide	100.2928	100.2928	100.2928	0	0	0	48.317	48.317	2438.6543	2486.9714	17708.8965	38973.25
Methane	0	0	0	0	0	0	0	0	3349.7366	3349.7366	0.0001	0.0001
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0.0086	0.0086	0.0001	0.0001
Ethane	0	0	0	0	0	0	0	0	0.0187	0.0187	0.0001	0.0001
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	3968.927	3968.9272	3968.9287	0	0	183718.703	1912.0685	1912.0697	22.7837	1934.8516	13259.0723	21269.373
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0.0002
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Ammonia	0	0	0	0	0	0	0	0	2.9338	2.9338	0.0001	0.0001
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	0	0	0	0	0	183718.703	0	0	0	0	0	0
Sulfur Dioxide	0	0	0	0	0	0	0	0	0	0	0	6.0849
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0.0162	0.0162	0.0001	0.0001
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	150.9756	960.4279
Methanol	0	0	0	0	0	0	0	0	787.7211	787.7211	0.0001	0.0001
Ethanol	0	0	0	0	0	0	0	0	44.6738	44.6738	0.0002	0.0002
N-Propanol	0	0	0	0	0	0	0	0	0.0189	0.0189	0.0002	0.0002
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	5.916	5.916	0.0003	0.0003
Acetic Acid	0	0	0	0	0	0	0	0	0.0301	0.0301	0.0002	0.0002
Methyl Acetate	0	0	0	0	0	0	0	0	676.8951	676.8951	0.0003	0.0003
Hydrogen Iodide	0	0	0	0	0	0	0	0	0.0038	0.0038	432.2128	432.2128
Methyl Iodide	0	0	0	0	0	0	0	0	479.6056	479.6056	0.0005	0.0005
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	210	220	230	231	232	233	234	240	302	303	304	305
Stream Name	VENT		LOCKHOP CO2									
Temp F	222.6651	215	70	70	329.5243	140	360.0685	215.803	363.5411	475	1600	1600
Pres psia	15	15	22	22	100	100	330	330	330	330	330	330
Enth MMBtu/h	-1171	-645.89	-23.166	-23.166	-22.829	-23.089	-22.801	-668.69	-898.74	-851.38	-857.61	-865.95
Vapor mole fraction	1	0	1	1	1	1	1	0.091986	0.60307	1	0.99258	0.99229
Total lbmol/h	16931.9824	1409.0208	136.8571	136.8571	136.8571	136.8571	136.8571	1545.8781	5311.5054	5311.5054	12891.7949	11909.8008
Total lb/h	390079.5	208771.234	6023.0801	6023.0801	6023.0801	6023.0801	6023.0801	214794.344	302898.5	302898.5	302898.5	295388.375
Total std L gpd	1253001.15	1330012	20944.8668	20944.8668	20944.8668	20944.8668	20944.8668	1350957.04	1589292.6	1589292.6	1308099.24	1261899.4
Total std V scfh	6425325.5	534693.25	51934.34	51934.34	51934.34	51934.34	51934.34	586627.69	2015602.75	2015602.75	4892160.5	4519515
Flowrates in lb/h												
Oxygen	6579.4609	0	0	0	0	0	0	0	46113.418	46113.418	307.1076	0
Nitrogen	160849	0	0	0	0	0	0	0	82.8463	82.8463	120.3801	82.8463
Argon	1266.4816	0	0	0	0	0	0	0	154.1381	154.1381	154.1381	154.1381
Carbon	0.0002	0	0	0	0	0	0	0	0	0	6254.9497	0
Hydrogen	11.6106	0	0	0	0	0	0	0	0	0	4562.5605	3655.0559
Carbon Monoxide	1065.4545	0	0	0	0	0	0	0	0	0	49736.8359	49736.8359
Carbon Dioxide	38973.25	0	6023.0801	6023.0801	6023.0801	6023.0801	6023.0801	6023.0801	6023.0801	6023.0801	135752.328	135752.328
Methane	0.0001	0	0	0	0	0	0	0	0	0	21336.9043	21336.9043
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0.0001	0	0	0	0	0	0	0	0	0	1041.307	1041.307
Ethane	0.0001	0	0	0	0	0	0	0	0	0	1948.7645	1948.7645
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	179935.531	25052.5449	0	0	0	0	0	25052.5488	66806.3047	66806.3047	62887.6133	62887.6133
Sulphur	0.0002	0	0	0	0	0	0	0	0	0	3.0449	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	0	0	0	0	0	0	0	0	0	0	35.064	35.064
Ammonia	0.0001	0	0	0	0	0	0	0	0	0	1312.5885	1312.5885
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	18.5296	18.5296
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	4960.3823	4960.3823
Benzene	0	0	0	0	0	0	0	0	0	0	8488.3818	8488.3818
Naphthalene	0	0	0	0	0	0	0	0	0	0	3977.6123	3977.6123
Hybrid Poplar Ch	0	183718.688	0	0	0	0	0	183718.703	183718.703	183718.703	0	0
Sulfur Dioxide	6.0849	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Cyanide	0.0001	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	960.4279	0	0	0	0	0	0	0	0	0	0	0
Methanol	0.0001	0	0	0	0	0	0	0	0	0	0	0
Ethanol	0.0002	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0.0002	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0.0003	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0.0002	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0.0003	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	432.2128	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0.0005	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	306	307	308	309	310	311	312	313	314	321	330	331
Stream Name			QUENCH H2	WET ASH	AIR					EXHAUST		
Temp F	1600	300	90	197.3746	60	173.0191	1600	413.425	3764.8915	2623.2631	1600	1383
Pres psia	330	330	60	60	14.696	25	330	25	25	25	330	327
Enth MMBtu/h	-41.992	-49.708	-62.541	-112.25	-0.48237	2.6782	8.3447	11.023	11.023	-36.335	-824.05	-775.49
Vapor mole fraction	0.0003125	0.0003125	0	0	1	1	1	1	1	1	1	1
Total lbmol/h	88.4566	88.4566	509.5717	598.0283	4000	4000	981.9965	4982	4257.6157	4257.6157	11821.3438	13688.0576
Total lb/h	4960.3823	4960.3823	9179.9326	14140.3145	115403.398	115403.398	7510.1406	122913.547	122913.477	122913.477	290428	290427.5
Total std L gpd	5708.3014	5708.3014	26400.0038	32108.3046	383595.835	383595.835	46199.7939	429795.629	426849.928	426849.928	1256191.1	1416457.19
Total std V scfh	33567.4	33567.4	193371.55	226938.94	1517914.38	1517914.38	372646.69	1890561.25	1615674.13	1615674.13	4485947.5	5194325.5
Flowrates in lb/h												
Oxygen	0	0	0	0	26879.2227	26879.2227	307.1076	27186.3301	3575.0068	3575.0068	0	0
Nitrogen	0	0	0	0	88524.1797	88524.1797	37.5337	88561.7109	88183.8594	88183.8594	82.8463	838.5153
Argon	0	0	0	0	0	0	0	0	0	0	154.1381	154.1381
Carbon	0	0	0	0	0	0	6254.9497	6254.9497	0.0002	0.0002	0	0
Hydrogen	0	0	0	0	0	0	907.5048	907.5048	11.1937	11.1937	3655.0559	8376.3027
Carbon Monoxide	0	0	0	0	0	0	0	0	1053.2295	1053.2295	49736.8359	82536
Carbon Dioxide	0	0	0	0	0	0	0	0	21264.3535	21264.3535	135752.328	135752.328
Methane	0	0	0	0	0	0	0	0	0	0	21336.9043	17069.5234
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	1041.307	520.6535
Ethane	0	0	0	0	0	0	0	0	0	0	1948.7645	194.8765
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	0	0	9179.9326	9179.9326	0	0	0	0	8010.3003	8010.3003	62887.6133	41792.4023
Sulphur	0	0	0	0	0	0	3.0449	3.0449	0.0002	0.0002	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	0	0	0	0	0	0	0	0	0	0	35.064	35.064
Ammonia	0	0	0	0	0	0	0	0	0	0	1312.5885	393.7766
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	18.5296	18.5296
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	4960.3823	4960.3823	0	4960.3823	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	8488.3818	2546.5144
Naphthalene	0	0	0	0	0	0	0	0	0	0	3977.6123	198.8806
Hybrid Poplar Ch	0	0	0	0	0	0	0	0	0	0	0	0
Sulfur Dioxide	0	0	0	0	0	0	0	0	6.0849	6.0849	0	0
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	809.4523	809.4523	0	0
Methanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	336	338	340	341	342	343	344	380	426	427	428	429
Stream Name			TO WWT			From V449					KO POT	
Temp F	498.0517	284.5574	117.0121	117.0121	110	110	110.0003	117.0121	188.7372	105	105	105
Pres psia	326	325	324	324	324	440	324	324	465	465	465	465
Enth MMBtu/h	-889.65	-914.89	-57706	-57129	-57189	-305.68	-57495	-697.55	-691.14	-699.05	-0.049876	-699
Vapor mole fraction	1	1	0	0	0.00040994	0	0.0004066	1	1	0.99978	0	1
Total lbmol/h	13688.0576	13688.0576	473346	468612.25	468612.25	2497.9185	471110.188	11405.9502	11405.9502	11405.9502	2.4709	11403.4785
Total lb/h	290427.5	290427.5	8553055	8467523	8467523	45000	8512523	249059.313	249059.313	249059.313	208.3418	248851
Total std L gpd	1416457.19	1416457.19	24687302.8	24440426.8	24440426.8	129412.723	24569839.3	1296592.31	1296592.31	1296592.31	612.9139	1295979.45
Total std V scfh	5194325.5	5194325.5	179624576	177828336	177828336	947906.69	178776240	4328314.5	4328314.5	4328314.5	937.67	4327376.5
Flowrates in lb/h												
Oxygen	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen	838.5153	838.5153	5.3605	5.3069	5.3069	0	5.3069	838.4612	838.4612	838.4612	0.0015	838.4596
Argon	154.1381	154.1381	2.8201	2.7919	2.7919	0	2.7919	154.1096	154.1096	154.1096	0.001	154.1086
Carbon	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	8376.3027	8376.3027	103.7165	102.6793	102.6793	0	102.6794	8375.2529	8375.2529	8375.2529	0.0118	8375.2412
Carbon Monoxide	82536	82536	1117.8942	1106.7152	1106.7152	0	1106.7152	82524.7188	82524.7188	82524.7188	0.216	82524.5
Carbon Dioxide	135752.328	135752.328	39081.3281	38690.5195	38690.5195	0	38690.5195	135358.578	135358.578	135358.578	11.8665	135346.719
Methane	17069.5234	17069.5234	277.2328	274.4605	274.4605	0	274.4604	17066.7227	17066.7227	17066.7227	0.1765	17066.5449
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	520.6535	520.6535	115.9311	114.7718	114.7718	0	114.7718	519.4804	519.4804	519.4804	0.0261	519.4543
Ethane	194.8765	194.8765	36.8037	36.4356	36.4356	0	36.4356	194.5043	194.5043	194.5043	0.0144	194.4899
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	41792.4023	41792.4023	8473341	8388607.5	8388607.5	45000	8433607	1216.9917	1216.9917	1216.9917	9.1653	1207.8279
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	35.064	35.064	24.2296	23.9873	23.9873	0	23.9873	34.8219	34.8219	34.8219	0.0084	34.8135
Ammonia	393.7766	393.7766	32108.9121	31787.8242	31787.8242	0	31787.8262	76.2977	76.2977	76.2977	0.0317	76.2659
HydrogenChloride	18.5296	18.5296	1830.7036	1812.3966	1812.3966	0	1812.3965	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	2546.5144	2546.5144	3780.9358	3743.1265	3743.1265	0	3743.1265	2510.7483	2510.7483	2510.7483	41.3645	2469.3904
Naphthalene	198.8806	198.8806	1227.5433	1215.2679	1215.2679	0	1215.2679	188.6347	188.6347	188.6347	145.4579	43.2001
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	430	431	432	433	434	435	441	443	445	447	448	449
Stream Name												
Temp F	120	120	120	707	707	707	900	1652	1348.4302	300.031	150	110
Pres psia	465	445	445	445	440	440	435	420	419	419	419	416.5
Enth MMBtu/h	-697.9	0	-697.82	-639.91	-0.0035603	-639.9	-1688.8	-1431.9	-1502.1	-1830.7	-1922.1	-1935.4
Vapor mole fraction	0.99855	0	0.99871	1	1	1	1	1	1	0.73691	0.61665	0.61233
Total lbmol/h	11403.4785	0	11403.4785	11403.4795	1.0216	11402.457	22402.6836	24449.8027	24449.8027	24449.8027	24449.8027	24449.8027
Total lb/h	248851	0	248851	248851.016	34.8135	248816.188	446985.188	446986	446986	446986	446986	446986
Total std L gpd	1295979.45	0	1295979.45	1295979.45	126.7156	1295852.71	1865754.8	2057562.56	2057562.56	2057562.56	2057562.56	2057562.56
Total std V scfh	4327376.5	0	4327376.5	4327376.5	387.69	4326988.5	8501340	9278178	9278178	9278178	9278178	9278178
Flowrates in lb/h												
Oxygen	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen	838.4596	0	838.4596	838.4596	0	838.4596	838.4596	886.7913	886.7913	886.7913	886.7913	886.7913
Argon	154.1086	0	154.1086	154.1086	0	154.1086	154.1086	154.1086	154.1086	154.1086	154.1086	154.1086
Carbon	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	8375.2412	0	8375.2412	8375.2412	0	8375.2412	8375.2412	15269.959	15269.959	15269.959	15269.959	15269.959
Carbon Monoxide	82524.5	0	82524.5	82524.5	0	82524.5	82524.5	100265.547	100265.547	100265.547	100265.547	100265.547
Carbon Dioxide	135346.719	0	135346.719	135346.719	0	135346.719	135346.719	155684.375	155684.375	155684.375	155684.375	155684.375
Methane	17066.5449	0	17066.5449	17066.5449	0	17066.5449	17066.5449	3390.415	3390.415	3390.415	3390.415	3390.415
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	519.4543	0	519.4543	519.4543	0	519.4543	519.4543	0.0457	0.0457	0.0457	0.0457	0.0457
Ethane	194.4899	0	194.4899	194.4899	0	194.4899	194.4899	0.0998	0.0998	0.0998	0.0998	0.0998
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	1207.8279	0	1207.8279	1207.8279	0	1207.8279	199377	171316.75	171316.75	171316.75	171316.75	171316.75
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	34.8135	0	34.8135	34.8135	34.8135	0	0	0	0	0	0	0
Ammonia	76.2659	0	76.2659	76.2659	0	76.2659	76.2659	17.4502	17.4502	17.4502	17.4502	17.4502
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	2469.3904	0	2469.3904	2469.3904	0	2469.3904	2469.3904	0	0	0	0	0
Naphthalene	43.2001	0	43.2001	43.2001	0	43.2001	43.2001	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0.0867	0.0867	0.0867	0.0867	0.0867
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	0	0	0	0	0	0	0.0468	0.0468	0.0468	0.0468	0.0468
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	450	451	452	453	456	471	472	473	474	477	490	491
Stream Name			CO2								AIR	
Temp F	110	120	120	60.1922	582.236	276.4184	140	234.105	140	182.3786	60	175.9875
Pres psia	416.5	411.5	411.5	22	440	800	800	1200	1200	1450	14.696	25
Enth MMBtu/h	-774.37	-232.91	-541.71	-541.71	-1754.4	-219.63	-231.23	-223.13	-231.21	-227.53	-1.705	9.7612
Vapor mole fraction	1	1	0.98914	0.99495	1	1	1	1	1	1	1	1
Total lbmol/h	14971.3877	11754.0625	3217.3259	3217.3259	22402.6836	11754.0625	11754.0625	11754.0625	11754.0625	11754.0625	14138.9619	14138.958
Total lb/h	275661.531	135454.25	140207.234	140207.234	446985.188	135454.25	135454.25	135454.25	135454.25	135454.25	407921	407921
Total std L gpd	1564274.87	1077291.77	486983.139	486983.139	1865754.8	1077291.77	1077291.77	1077291.77	1077291.77	1077291.77	1355911.32	1355911.32
Total std V scfh	5681321.5	4460415.5	1220906.38	1220906.38	8501340	4460415.5	4460415.5	4460415.5	4460415.5	4460415.5	5365434	5365432.5
Flowrates in lb/h												
Oxygen	0	0	0	0	0	0	0	0	0	0	95011.1797	95011.1797
Nitrogen	886.7906	886.7906	0	0	838.4596	886.7906	886.7906	886.7906	886.7906	886.7906	312910	312910
Argon	154.1028	154.1028	0	0	154.1086	154.1028	154.1028	154.1028	154.1028	154.1028	0	0
Carbon	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	15269.9092	15269.9092	0	0	8375.2412	15269.9092	15269.9092	15269.9092	15269.9092	15269.9092	0	0
Carbon Monoxide	100265.414	100265.414	0	0	82524.5	100265.414	100265.414	100265.414	100265.414	100265.414	0	0
Carbon Dioxide	154717.625	15471.7705	139245.844	139245.844	135346.719	15471.7705	15471.7705	15471.7705	15471.7705	15471.7705	0	0
Methane	3390.3635	3390.3635	0	0	17066.5449	3390.3635	3390.3635	3390.3635	3390.3635	3390.3635	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0.0457	0.0457	0	0	519.4543	0.0457	0.0457	0.0457	0.0457	0.0457	0	0
Ethane	0.0998	0.0998	0	0	194.4899	0.0998	0.0998	0.0998	0.0998	0.0998	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	961.3967	0	961.3967	961.3955	199377	0	0	0	0	0	0	0
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Ammonia	15.675	15.675	0	0	76.2659	15.675	15.675	15.675	15.675	15.675	0	0
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	2469.3904	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	43.2001	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0.0866	0.0866	0	0	0	0.0866	0.0866	0.0866	0.0866	0.0866	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0.0026	0.0026	0	0	0	0.0026	0.0026	0.0026	0.0026	0.0026	0	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	493	494	495	496	497	498	499	505	517	518	519	520
Stream Name				To LOCAT&ZnO		FLUE GAS			GAS OUT			
Temp F	161.2468	1800	1800	1343.1625	757.2543	285.7432	305.2643	500	500	354.5034	150	110
Pres psia	15	15	15	14	14	14	15	1350	1350	1350	1340	1335
Enth MMBtu/h	-93.652	-350.76	-350.76	-416.36	-495.37	-554.35	-551.98	-616.23	-616.23	-638.06	-714.99	-723.97
Vapor mole fraction	1	1	1	1	1	1	1	1	1	1	0.73416	0.72298
Total lbmol/h	16387.8457	16062.1289	16062.1289	16062.2129	16062.2129	16062.2129	16062.2129	13662.2734	13662.2734	13662.2734	13662.2734	13662.2734
Total lb/h	453487.281	453487	453487	453490.5	453490.5	453490.5	453490.5	264008.688	264008.688	264008.688	264008.688	264008.688
Total std L gpd	1640724.71	1557283.51	1557283.51	1557299.1	1557299.1	1557299.1	1557299.1	1496521.32	1496521.32	1496521.32	1496521.32	1496521.32
Total std V scfh	6218837	6095234.5	6095234.5	6095266.5	6095266.5	6095266.5	6095266.5	5184540.5	5184540.5	5184540.5	5184540.5	5184540.5
Flowrates in lb/h												
Oxygen	95011.1797	11832.1846	11832.1846	11828.624	11828.624	11828.624	11828.624	0	0	0	0	0
Nitrogen	313630	313618	313618	313618	313618	313618	313618	8571.418	8571.418	8571.418	8571.418	8571.418
Argon	125.2416	125.2416	125.2416	125.2441	125.2441	125.2441	125.2441	1377.9016	1377.9016	1377.9016	1377.9016	1377.9016
Carbon	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	1118.4425	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	10235.2529	10235.2529	10235.2529	10235.2529	10235.2529
Carbon Monoxide	9713.8516	0.0197	0.0197	0.0198	0.0198	0.0198	0.0198	41675.7227	41675.7227	41675.7227	41675.7227	41675.7227
Carbon Dioxide	10583.7529	76723.4688	76723.4688	76729.7813	76729.7813	76729.7813	76729.7813	57448.4727	57448.4727	57448.4727	57448.4727	57448.4727
Methane	14538.2324	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	29042.9707	29042.9707	29042.9707	29042.9707	29042.9707
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0.0372	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.2816	0.2816	0.2816	0.2816	0.2816
Ethane	0.0811	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.6147	0.6147	0.6147	0.6147	0.6147
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	98.7991	49263.5977	49263.5977	49264.5391	49264.5391	49264.5391	49264.5391	1256.3688	1256.3688	1256.3688	1256.3688	1256.3688
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Ammonia	12.7385	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	24.127	24.127	24.127	24.127	24.127
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0.0704	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.1008	0.1008	0.1008	0.1008	0.1008
Nitric Oxide	0	48.4458	48.4458	48.4386	48.4386	48.4386	48.4386	0	0	0	0	0
Methanol	3418.7788	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	114375.484	114375.484	114375.484	114375.484	114375.484
Ethanol	193.9275	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0	0	0	0	0
N-Propanol	0.0821	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	25.6601	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0	0	0	0	0
Acetic Acid	0.1306	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0	0	0	0	0
Methyl Acetate	2934.8042	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0	0	0	0	0
Hydrogen Iodide	0.0163	1875.834	1875.834	1876.0927	1876.0927	1876.0927	1876.0927	0	0	0	0	0
Methyl Iodide	2081.5222	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	521	523	524	525	527	528	535	536	537	538	539	540
Stream Name			TO WWT									
Temp F	109.9955	109.9955	109.9955	105.1495	105.1495	105.1495	109.9955	126.1507	420	292.3728	482	109.9955
Pres psia	1334	1334	1334	35	35	35	1334	1450	1450	1450	1450	1334
Enth MMBtu/h	-723.97	-326.19	-397.79	-397.79	-28.609	-369.18	-293.57	-292.45	-270.62	-498.15	-467.6	-32.619
Vapor mole fraction	0.72299	1	0	0.063849	1	0	1	1	1	1	1	1
Total lbmol/h	13662.2754	9877.6934	3784.582	3784.5818	241.6431	3542.9385	8889.9238	8889.9238	8889.6631	20643.7227	20643.7227	987.7691
Total lb/h	264008.719	142837.344	121171.398	121171.391	8313.6494	112857.734	128553.602	128553.602	128553.117	264007.344	264007.344	14283.7354
Total std L gpd	1496521.32	1058409.82	438111.465	438111.424	33662.0738	404449.327	952569.001	952569.001	952548.494	2029839.94	2029839.94	105841.002
Total std V scfh	5184541.5	3748373.5	1436168	1436167.88	91698.38	1344469.38	3373536	3373536	3373437	7833851.5	7833851.5	374837.25
Flowrates in lb/h												
Oxygen	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen	8571.418	8539.3457	32.0721	32.0721	31.955	0.1171	7685.4111	7685.4111	7684.627	8571.418	8571.418	853.9346
Argon	1377.9017	1359.7781	18.1236	18.1236	17.878	0.2456	1223.8002	1223.8002	1223.7988	1377.9016	1377.9016	135.9778
Carbon	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	10235.2529	10198.8281	36.4243	36.4243	36.3061	0.1182	9178.9453	9178.9453	9178.3916	24448.2988	24448.2988	1019.8828
Carbon Monoxide	41675.7266	41379.6875	296.0408	296.0408	293.9359	2.1049	37241.7188	37241.7188	37242.4063	137507.813	137507.813	4137.9688
Carbon Dioxide	57448.4727	50033.207	7415.2632	7415.2632	6212.9766	1202.2866	45029.8828	45029.8828	45029.7617	60501.5313	60501.5313	5003.3203
Methane	29043	28502.5293	540.4439	540.4439	529.3613	11.0825	25652.2754	25652.2754	25652.6074	29042.9707	29042.9707	2850.2529
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0.2816	0.2621	0.0195	0.0195	0.0178	0.0017	0.2359	0.2359	0.2359	0.2816	0.2816	0.0262
Ethane	0.6147	0.5721	0.0426	0.0426	0.0388	0.0038	0.5148	0.5148	0.5149	0.6147	0.6147	0.0572
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	1256.3687	7.3699	1249	1249	3.4895	1245.5094	6.6329	6.6329	6.6324	6.6324	6.6324	0.737
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Ammonia	24.127	9.3924	14.7346	14.7346	4.3423	10.3923	8.4531	8.4531	8.452	24.127	24.127	0.9392
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0.1008	0.0158	0.085	0.085	0.0076	0.0774	0.0142	0.0142	0.0142	0.1008	0.1008	0.0016
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	114375.477	2806.3503	111569.148	111569.141	1183.3406	110385.789	2525.7151	2525.7151	2525.6709	2525.6736	2525.6736	280.635
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	601	605	606	610	615	620	702	703	704	706	707	708
Stream Name				MeOH	to WWT		FROM TAR I	FROM STM REF			TO STM REF	TO REF REC
Temp F	152.1663	177.358	177.3581	152.108	203.5233	203.5233	574.7471	574.747	574.7458	575	575	575
Pres psia	23	26.7	26.7	16	22	22	1280	1280	1280	1282.5627	1282.5627	1282.5627
Enth MMBtu/h	-10.543	-350.55	-348.11	-342.71	-7.2604	-7.2604	-808.06	-1905.2	-2713.2	-2686.2	-1263.5	-1422.7
Vapor mole fraction	1	0	0	0	0	0	1	1	1	1	1	1
Total lbmol/h	97.6661	3445.2722	3445.2722	3383.3999	61.8722	61.8722	7882.3203	18584.2695	26466.5898	26201.9238	12324.5986	13877.3252
Total lb/h	3434.1133	109423.617	109423.617	108173.617	1250.0004	1250.0004	142000	334795.594	476796	472028	222027.641	250000
Total std L gpd	12279.3806	392169.946	392169.946	388353.647	3816.2936	3816.2936	408369.026	962818.068	1371187.09	1357475.24	638515.608	718959.593
Total std V scfh	37062.21	1307407.13	1307407.13	1283928	23479.19	23479.19	2991172	7052333	10043505	9943070	4676921.5	5266148.5
Flowrates in lb/h												
Oxygen	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen	0.1171	0	0	0	0	0	0	0	0	0	0	0
Argon	0.2456	0	0	0	0	0	0	0	0	0	0	0
Carbon	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	0.1182	0	0	0	0	0	0	0	0	0	0	0
Carbon Monoxide	2.1049	0	0	0	0	0	0	0	0	0	0	0
Carbon Dioxide	1202.2866	0	0	0	0	0	0	0	0	0	0	0
Methane	11.0825	0	0	0	0	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0.0017	0	0	0	0	0	0	0	0	0	0	0
Ethane	0.0038	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	0	1245.5094	1245.5094	304.7399	940.7694	940.7694	142000	334795.594	476796	472028	222027.641	250000
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Ammonia	10.3923	0	0	0	0	0	0	0	0	0	0	0
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0.0475	0.0299	0.0299	0.0299	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	2207.7131	108178.078	108178.078	107868.844	309.231	309.231	0	0	0	0	0	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	710	712	715	718	719	720	721	725	731	732	733	734
Stream Name			VENT			FROM STM	FROM REF REC			TO STM REF	TO GASIFIE	TO MeOH SY
Temp F	575	575.0002	225.2323	575.0002	200	1000	1000	1000	715.2511	715.2511	715.2511	715.2511
Pres psia	1282.5627	1282.5627	30	1282.5627	1282.5627	1265	1265	1265	450	450	450	450
Enth MMBtu/h	-29.967	0	0	-29.967	-31.958	-1193.2	-1343.5	-2536.6	-2597.5	-282.63	-229.77	-181.19
Vapor mole fraction	0	1	1	0	0	1	1	1	1	1	1	1
Total lbmol/h	264.666	0	0	264.666	264.666	12324.6191	13877.3252	26201.9453	26201.9453	2850.9575	2317.7354	1827.7549
Total lb/h	4767.958	0	0	4767.958	4767.958	222028	250000	472028.031	472028.031	51360	41754	32927.0039
Total std L gpd	13711.8769	0	0	13711.8769	13711.8769	638516.675	718959.593	1357476.31	1357476.31	147703.056	120077.761	94692.7405
Total std V scfh	100435.09	0	0	100435.09	100435.09	4676929.5	5266148.5	9943078	9943078	1081877.38	879531	693593.94
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	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
Carbon Monoxide	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Methane	0	0	0	0	0	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	4767.958	0	0	4767.958	4767.958	222028	250000	472028.031	472028.031	51360	41754	32927.0039
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	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
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	736	737	741	743	744	745	746	747	751	761	762	770
Stream Name				TO EtOH HX	TO EtOH REBR							MAKE UP
Temp F	715.2511	456.586	276.0588	276.0588	276.0588	276.0588	276.0588	276.0588	163.3197	163.3197	163.4348	60
Pres psia	450	450	35	35	35	35	35	35	5	5	35	60
Enth MMBtu/h	-1903.9	-831.87	-1970.5	-20.344	-596.4	-546.75	-724.42	-82.582	-737.8	-857.23	-857.21	-1699.2
Vapor mole fraction	1	1	1	1	1	1	1	1	0.93904	1.00E-06	0	0
Total lbmol/h	19205.498	8149.2935	19205.498	198.2792	5812.8779	5328.8921	7060.5635	804.8848	7060.5635	7060.5635	7060.5635	13784.2246
Total lb/h	345987.031	146809.516	345987.031	3572	104719	96000	127196.047	14500	127196.047	127196.047	127196.047	248323
Total std L gpd	995002.782	422200.438	995002.782	10272.4931	301154.902	276080.452	365795.259	41699.6519	365795.259	365795.259	365795.259	714136.237
Total std V scfh	7288076	3092482.75	7288076	75242.71	2205863	2022200.63	2679333	305436.56	2679333	2679333	2679333	5230818.5
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	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
Carbon Monoxide	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Methane	0	0	0	0	0	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	345987.031	146809.516	345987.031	3572	104719	96000	127196.047	14500	127196.047	127196.047	127196.047	248323
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	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
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	771	772	773	775	776	777	778	781	782	783	784	785
Stream Name			METH CONI	From EtOH P						HP BFW	TO R500	
Temp F	68.0165	251.3727	456	251.3706	338.9405	251.3728	225.2323	225.598	225.598	230.0412	225.598	226.9317
Pres psia	60	30	450	30	115	30	30	125	125	1280	125	450
Enth MMBtu/h	-1697.2	-637.9	-211.77	-1170.5	-952.06	-2972.2	-5609.3	-5608.9	-3183.4	-3181.3	-990.1	-989.9
Vapor mole fraction	0	0.006109	0	0	0	0.049196	0	0	0	0	0	0
Total lbmol/h	13784.2246	5328.8921	1827.7548	9769.5811	8056.0645	24982.293	46632	46632	26466.6543	26466.6543	8231.5293	8231.5293
Total lb/h	248323	96000	32927	175999	145130	450056	840075	840075	476797	476797	148291	148291
Total std L gpd	714136.237	276080.452	94692.7302	506144.695	417370.438	1294288.29	2415919.19	2415919.19	1371190.46	1371190.46	426460.935	426460.935
Total std V scfh	5230818.5	2022200.63	693593.88	3707347.25	3057104.25	9480246	17695832	17695832	10043530	10043530	3123689.5	3123689.5
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	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
Carbon Monoxide	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Methane	0	0	0	0	0	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	248323	96000	32927	175999	145130	450056	840075	840075	476797	476797	148291	148291
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	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
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	786	792	793	794	796	801	802	803	804	805	806	810
Stream Name				TO TURBINE	TO TURBINE							Cata.&Chem
Temp F	225.598	574.7471	574.747	1000	1000	152.2731	152.4675	152.4675	152.4675	152.4675	155.9419	59
Pres psia	125	1280	1280	1265	1265	16	40	40	40	40	470	14.7
Enth MMBtu/h	-1435.4	-808.06	-1905.2	-1193.2	-1343.5	-342.7	-342.69	-339.26	-1.7134	-1.7134	-339.01	-0.11473
Vapor mole fraction	0	1	1	1	1	1.00E-07	0	0	0	0	0	0
Total lbmol/h	11933.7773	7882.3203	18584.2695	12324.6191	13877.3252	3383.3999	3383.3999	3349.5659	16.917	16.917	3349.5659	18
Total lb/h	214987	142000	334795.594	222028	250000	108173.617	108173.617	107091.883	540.8681	540.8681	107091.883	2554.9019
Total std L gpd	618267.835	408369.026	962818.068	638516.675	718959.593	388353.647	388353.647	384470.124	1941.7682	1941.7682	384470.124	3197.8495
Total std V scfh	4528613.5	2991172	7052333	4676929.5	5266148.5	1283928	1283928	1271088.63	6419.64	6419.64	1271088.63	6830.62
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	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
Carbon Monoxide	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Methane	0	0	0	0	0	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	214987	142000	334795.594	222028	250000	304.7399	304.7399	301.6925	1.5237	1.5237	301.6925	0
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	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
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0.0299	0.0299	0.0296	0.0001	0.0001	0.0296	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	0	0	0	0	107868.844	107868.844	106790.156	539.3442	539.3442	106790.156	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	2554.9019
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	811	815	816	820	821	822	825	826	827	830	831	832
Stream Name												
Temp F	65.0812	155.4797	300	250	205.1333	372	323.2867	323.2867	251.9737	274.9917	274.9925	274.9925
Pres psia	480	470	465	470	465	445	440	440	40	35	35	35
Enth MMBtu/h	-0.1126	-339.12	-326.94	-168.86	-874.18	-990.33	-1002.5	-1002.5	-1002.5	-949.8	-837.56	-112.23
Vapor mole fraction	0	0	0	1	0.4195	0.068985	0.048436	0.048436	0.24723	0.9	1	0
Total lbmol/h	18	3367.5659	3367.5659	3568	9478.6445	6192.7285	6192.7285	6192.7285	6192.729	6192.729	5573.4307	619.2986
Total lb/h	2554.9019	109646.781	109646.781	99939.6797	330132.063	330135.281	330135.281	330135.281	330135.281	330135.281	295391	34744.457
Total std L gpd	3197.8495	387667.989	387667.989	358904.06	1065762.28	896576.358	896576.358	896576.358	896576.358	896576.358	801652.915	94923.3406
Total std V scfh	6830.62	1277919.25	1277919.25	1353979.75	3596943	2350008	2350008	2350008	2350008.25	2350008.25	2114997.75	235010.58
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	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
Carbon Monoxide	0	0	0	99939.6797	99941.6172	7520.125	7520.125	7520.125	7520.125	7520.125	7519.3403	0.7851
Carbon Dioxide	0	0	0	0	3.3727	605.1452	605.1452	605.1452	605.1453	605.1453	604.5661	0.5791
Methane	0	0	0	0	0.078	219.4426	219.4426	219.4426	219.4426	219.4426	219.4172	0.0254
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	0	301.6925	301.6925	0	21973.418	22546.2285	22546.2285	22546.2285	22546.2285	22546.2285	21342.9648	1203.2643
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Ammonia	0	0	0	0	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0.0296	0.0296	0	0.0974	0.0974	0.0974	0.0974	0.0974	0.0974	0.0952	0.0022
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	106790.156	106790.156	0	106802.445	58.1955	58.1955	58.1955	58.1955	58.1955	56.7289	1.4666
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	38414.0469	233671	233671	233671	233671	233671	201543.781	32127.0293
Methyl Acetate	0	0	0	0	42407.2773	44829.0742	44829.0742	44829.0742	44829.0742	44829.0742	43720.1797	1108.8945
Hydrogen Iodide	0	0	0	0	98.8697	445.7567	445.7567	445.7567	445.7567	445.7567	346.9322	98.8245
Methyl Iodide	2554.9019	2554.9019	2554.9019	0	20445.2246	20060.2988	20060.2988	20060.2988	20060.2969	20060.2969	19897.582	162.7161
Propionic Acid	0	0	0	0	45.5783	180.1224	180.1224	180.1224	180.1224	180.1224	139.2532	40.8692

Stream No.	833	835	836	837	840	841	842	843	844	845	846	848
Stream Name												
Temp F	278.0502	276.3222	273.3799	275.9162	232.1246	100	100	100	100	295.0805	295.0805	100
Pres psia	470	34	34	34	29	29	29	29	29	34	34	29
Enth MMBtu/h	-112.17	-837.56	-839.28	-839.28	-771	-915.35	-889.68	-25.67	-625.05	-618.84	-618.83	-264.79
Vapor mole fraction	0	1	1	1	1	0.045893	0	1	6.87E-06	0	0	0
Total lbmol/h	619.3493	5573.4307	5590.3477	5590.3477	8253.5996	8253.5996	7874.8174	378.782	5965.0034	3301.7502	3301.719	1910.9302
Total lb/h	34747.2188	295391	295932	295931.688	362179.281	362179.281	346873	15306.3926	261868.234	195620.641	195618.797	85062.4688
Total std L gpd	94931.0618	801652.915	803594.677	803499.931	770692.928	770692.928	723485.995	47206.8197	501003.223	533810.226	533805.181	222634.776
Total std V scfh	235029.83	2114997.75	2121417.5	2121417.5	3132064.5	3132064.5	2988324.75	143739.67	2263591.25	1252943.63	1252931.75	725157.13
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	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
Carbon Monoxide	0.7851	7519.3403	7519.3403	7519.3403	7523.8862	7523.8862	5.681	7518.2051	4.5458	0	0	1.1365
Carbon Dioxide	0.5792	604.5661	604.5661	604.5661	615.618	615.618	13.8118	601.8062	11.052	0	0	2.763
Methane	0.0254	219.4172	219.4172	219.4172	219.6255	219.6255	0.2603	219.3652	0.2083	0	0	0.0521
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	1203.4497	21342.9648	21344.4883	21676.7578	101932.703	101932.703	101751.438	181.2576	81409.0234	1153.0837	1153.0693	20352.2578
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Ammonia	0	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0	0.0002	0	0	0
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0.0022	0.0952	0.0953	0.0953	0.3537	0.3537	0.3229	0.0308	0.2584	0	0	0.0646
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	1.4667	56.7289	596.0731	5.0918	24.3029	24.3029	24.0173	0.2856	19.2137	0.0026	0.0026	4.8034
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	32128.8809	201543.781	201543.781	200599.031	12558.2441	12558.2441	12546.6348	11.6094	6273.6323	194314.422	194312.578	6273.6323
Methyl Acetate	1109.5746	43720.1797	43720.1797	44885.5859	62456.8477	62456.8477	58577.8867	3878.9617	17583.8066	12.546	12.5481	41028.875
Hydrogen Iodide	98.8514	346.9322	346.9322	0.0347	0.1071	0.1071	0.0905	0.0166	0.0724	0	0	0.0181
Methyl Iodide	162.7333	19897.582	19897.582	20282.5215	176824.125	176824.125	173929.281	2894.8386	156547.656	6.0459	6.0446	17394.1836
Propionic Acid	40.8709	139.2532	139.2532	139.2532	23.471	23.471	23.4549	0.0161	18.7654	134.5476	134.5432	4.6913

Stream No.	849	850	851	852	855	861	873	875	901	902	904	905
Stream Name												
Temp F	103.19	99.7958	88.6158	92.3454	95.8761	338.574	338.9426	338.9426	284.4628	290.267	223.6045	372.9145
Pres psia	470	28	27	28	470	115	115	115	29	890	890	885
Enth MMBtu/h	-264.65	-25.67	-25.839	-1.547	-1.5459	-395.56	-555.75	-555.75	-620.17	-619.44	-634.11	-566.13
Vapor mole fraction	0	1	1	0	0	1.00E-06	8.95E-05	8.95E-05	1.00E-07	0	0.88878	1
Total lbmol/h	1910.9302	378.782	382.9489	12.7608	12.7608	3350.5142	4702.7139	4702.7139	3301.72	3301.72	28998.2363	28998.2363
Total lb/h	85062.4688	15306.3926	15113.2646	734.6376	734.6376	60359.5117	84719.3906	84719.3906	195619	195619	256754	256754
Total std L gpd	222634.776	47206.8197	47531.0636	1620.0048	1620.0048	173584.191	243639.267	243639.267	533805.222	533805.222	2674910.38	2674910.38
Total std V scfh	725157.13	143739.67	145320.94	4842.47	4842.47	1271448.5	1784579.38	1784579.38	1252932.13	1252932.13	11004211	11004211
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	0	0	0	0	0	0	0	0	0	0	51287.918	51287.918
Carbon Monoxide	1.1365	7518.2051	7518.1914	0.0115	0.0115	0	0	0	0	0	5.5262	5.5262
Carbon Dioxide	2.763	601.8062	601.7759	0.0305	0.0305	0	0	0	0	0	125.173	125.173
Methane	0.0521	219.3652	219.3647	0.0005	0.0005	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	20352.2578	181.2576	66.7755	116.013	116.013	60359.5117	84719.3906	84719.3906	1153.0696	1153.0696	2625.7427	2625.7427
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	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
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0.0646	0.0308	0.03	0.001	0.001	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	4.8034	0.2856	534.832	4.7977	4.7977	0	0	0	0.0026	0.0026	1.181	1.181
Ethanol	0	0	0	0	0	0	0	0	0	0	7256.9907	7256.9907
N-Propanol	0	0	0	0	0	0	0	0	0	0	3.0258	3.0258
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	975.9128	975.9128
Acetic Acid	6273.6323	11.6094	0.0725	11.5333	11.5333	0	0	0	194312.594	194312.594	194316	194316
Methyl Acetate	41028.875	3878.9617	3611.0669	268.8271	268.8271	0	0	0	12.5481	12.5481	13.074	13.074
Hydrogen Iodide	0.0181	0.0166	0.0164	0.0002	0.0002	0	0	0	0	0	0	0
Methyl Iodide	17394.1836	2894.8386	2561.1396	333.4066	333.4066	0	0	0	6.0446	6.0446	8.9576	8.9576
Propionic Acid	4.6913	0.0161	0	0.0161	0.0161	0	0	0	134.5432	134.5432	134.5439	134.5439

Stream No.	906	907	908	910	912	914	915	921	922	923	925	926
Stream Name				H2								
Temp F	482	482	482	59	202.8157	150	287.5	303.6045	303.6045	150	150	150
Pres psia	880	870	870	300	500	498	890	865	865	860	860	860
Enth MMBtu/h	-538.24	-634.61	-634.67	-0.78094	3.9966	1.5056	8.0074	-702.65	-702.65	-801.93	-24.158	-0.48316
Vapor mole fraction	1	1	1	1	1	1	1	0.91753	0.91753	0.74713	1	1
Total lbmol/h	28998.2344	25826.6348	25824.8203	6795	6795	6795	6795	25824.3008	25824.3008	25824.3008	19294.0918	385.8818
Total lb/h	256754	256752	256752	13697.3613	13697.3613	13697.3613	13697.3613	256749	256749	256749	48422.5195	968.4504
Total std L gpd	2674910.38	2322101.52	2321895.46	562734.239	562734.239	562734.239	562734.239	2321850.51	2321850.51	2321850.51	1611151.79	32223.0432
Total std V scfh	11004210	9800656	9799967	2578557.25	2578557.25	2578557.25	2578557.25	9799770	9799770	9799770	7321695.5	146433.91
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	51287.918	38501	38493.6523	13697.3613	13697.3613	13697.3613	13697.3613	38492.7539	38492.7539	38492.7539	38371.3008	767.426
Carbon Monoxide	5.5262	5.6639	5.6639	0	0	0	0	5.6638	5.6638	5.6638	5.6384	0.1128
Carbon Dioxide	125.173	131.5312	131.5312	0	0	0	0	131.5321	131.5321	131.5321	127.673	2.5535
Methane	0	0	0	0	0	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	2625.7427	60817.2539	60850	0	0	0	0	60849.332	60849.332	60849.332	1503.2531	30.0651
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	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
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	1.181	32.9253	32.9253	0	0	0	0	32.925	32.925	32.925	1.2028	0.0241
Ethanol	7256.9907	150640	150640	0	0	0	0	150638.203	150638.203	150638.203	7407.8018	148.156
N-Propanol	3.0258	3.0258	112.0643	0	0	0	0	112.0551	112.0551	112.0551	3.0888	0.0618
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	975.9128	6179.0073	6179.0073	0	0	0	0	6179.0278	6179.0278	6179.0278	995.7883	19.9158
Acetic Acid	194316	295.8257	295.8257	0	0	0	0	295.8272	295.8272	295.8272	3.2668	0.0653
Methyl Acetate	13.074	2.371	2.371	0	0	0	0	2.371	2.371	2.371	0.5366	0.0107
Hydrogen Iodide	0	0.1666	0.1666	0	0	0	0	0.1665	0.1665	0.1665	0	0
Methyl Iodide	8.9576	8.7646	8.7646	0	0	0	0	8.7627	8.7627	8.7627	2.9741	0.0595
Propionic Acid	134.5439	134.5439	0.1345	0	0	0	0	0.1345	0.1345	0.1345	0.0007	0

Stream No.	927	928	929	930	931	932	933	934	935	936	941	942
Stream Name												
Temp F	150	144.1083	144.1083	161.5752	194.5772	144.1083	150	148.5154	148.5044	148.5044	198.6155	250.3707
Pres psia	860	35	35	890	890	35	860	35	35	35	25	30
Enth MMBtu/h	-23.675	-0.85936	-1.5277	-22.679	-14.671	-2.3871	-777.77	-777.77	-1.904	-775.87	-494.85	-385.4
Vapor mole fraction	1	1	1	1	1	1	0	0.011686	1	0	1	0
Total lbmol/h	18908.2109	167.0805	297.032	18908.2109	25703.2109	464.1126	6530.2114	6530.2119	78.2307	6451.9805	4883.4707	3217
Total lb/h	47454.0781	643.2134	1143.4905	47454.0781	61151.4375	1786.7039	208326.219	208326.219	818.2535	207508	195158.594	58159
Total std L gpd	1578928.93	14257.2334	25346.1945	1578928.93	2141663.13	39603.4254	710698.554	710698.554	7380.3879	703318.203	687310.83	167212.629
Total std V scfh	7175262	63403.47	112717.31	7175262	9753819	176120.8	2478075.75	2478075.75	29686.89	2448388.75	1853172.75	1220782.13
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	37603.875	319.8622	568.644	37603.875	51301.2344	888.5062	121.4514	121.4514	121.0802	0.3711	0.3711	0
Carbon Monoxide	5.5256	0.0497	0.0884	5.5256	5.5256	0.1382	0.0255	0.0255	0.0254	0.0001	0.0001	0
Carbon Dioxide	125.1195	2.2464	3.9937	125.1195	125.1195	6.2401	3.8591	3.8591	3.6866	0.1725	0.1725	0
Methane	0	0	0	0	0	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	1473.188	50.5638	89.8912	1473.188	1473.188	140.455	59346.0742	59346.0742	110.3899	59235.6836	20720.2422	57866.4883
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	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
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	1.1788	0.0599	0.1066	1.1788	1.1788	0.1665	31.7222	31.7222	0.1424	31.5797	31.5797	0
Ethanol	7259.646	238.6149	424.2043	7259.646	7259.646	662.8192	143230.406	143230.406	514.6631	142715.734	169174.328	0
N-Propanol	3.027	0.1011	0.1797	3.027	3.027	0.2807	108.9663	108.9663	0.2189	108.7474	108.7474	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	975.8725	31.573	56.1298	975.8725	975.8725	87.7029	5183.2393	5183.2388	67.7871	5115.4517	5115.4517	0
Acetic Acid	3.2015	0.0883	0.1569	3.2015	3.2015	0.2451	292.5603	292.5603	0.1798	292.3805	0.002	292.3786
Methyl Acetate	0.5258	0.0152	0.027	0.5258	0.5258	0.0421	1.8345	1.8345	0.0314	1.8031	1.8031	0
Hydrogen Iodide	0	0.0037	0.0065	0	0	0.0102	0.1665	0.1665	0.0102	0.1563	0.1563	0
Methyl Iodide	2.9146	0.0352	0.0625	2.9146	2.9146	0.0977	5.7886	5.7886	0.0382	5.7503	5.7503	0
Propionic Acid	0.0007	0	0	0.0007	0.0007	0.0001	0.1338	0.1338	0	0.1338	0	0.1338

Stream No.	943	944	946	947	948	949	950	951	952	955	960	971
Stream Name												
Temp F	250.3707	240.4	240.4	240.4	100	100.0184	169.6233	169.7189	169.7786	197.06	98.6	342.1166
Pres psia	30	23	23	23	18	21	18.5	35	35	21	16	120
Enth MMBtu/h	-385.4	-491.46	-324.37	-167.09	-199.83	-199.83	-197.27	-197.27	-197.39	-326.93	-389.09	-667.96
Vapor mole fraction	0	1	1	1	0	0	0	0	0	1	0	0.99
Total lbmol/h	3217	4883.4702	3233.3662	1650.1038	1650.1038	1650.1038	1650.1038	1650.1038	1648.4883	3233.366	3233.3652	6517.541
Total lb/h	58159	195158.594	149309.375	45849.2109	45849.2109	45849.2109	45849.2109	45849.2109	45809.6367	149309.359	149309.344	117413.5
Total std L gpd	167212.629	687310.83	535979.009	151331.78	151331.78	151331.78	151331.78	151331.78	151205.339	535978.968	535978.927	337662.253
Total std V scfh	1220782.75	1853172.5	1226993.38	626179.13	626179.13	626179.13	626179.13	626179.13	625566.06	1226993.25	1226993	2473267.5
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	0	0.3711	0.3711	0	0	0	0	0	0	0.3711	0.3711	0
Carbon Monoxide	0	0.0001	0.0001	0	0	0	0	0	0	0.0001	0.0001	0
Carbon Dioxide	0	0.1725	0.1725	0	0	0	0	0	0	0.1725	0.1725	0
Methane	0	0	0	0	0	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	57866.4883	20720.2422	1346.8147	19373.4277	19373.4277	19373.4277	19373.4277	19373.4277	19351.0449	1346.8147	1346.8138	117413.5
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	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
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	31.5797	31.5797	0	0	0	0	0	0	31.5797	31.5797	0
Ethanol	0	169174.328	142698.531	26475.7813	26475.7813	26475.7813	26475.7813	26475.7813	26458.5938	142698.516	142698.5	0
N-Propanol	0	108.7474	108.7474	0	0	0	0	0	0	108.7473	108.7473	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	5115.4517	5115.4517	0	0	0	0	0	0	5115.4517	5115.4492	0
Acetic Acid	292.3786	0.002	0.002	0	0	0	0	0	0	0.002	0.002	0
Methyl Acetate	0	1.8031	1.8031	0	0	0	0	0	0	1.8031	1.8031	0
Hydrogen Iodide	0	0.1563	0.1563	0	0	0	0	0	0	0.1563	0.1563	0
Methyl Iodide	0	5.7503	5.7503	0	0	0	0	0	0	5.7503	5.7503	0
Propionic Acid	0.1338	0	0	0	0	0	0	0	0	0	0	0

Stream No.	972	973	974	975	976	977	978	981	982	985	986	1601
Stream Name							To EtOH Rebr					NATURAL G
Temp F	342.1166	342.1166	342.1166	342.1166	342.1166	342.1166	342.1166	345.1872	342.1165	251.3727	251.3727	60
Pres psia	120	120	120	120	120	120	120	125	120	30	30	15
Enth MMBtu/h	-555.1	-1223.1	-14.1	-1209	-342.9	-481.47	-384.59	-667.88	-555.1	-1146.7	-1146.7	-28.775
Vapor mole fraction	0.99	0.99	0	1	1	1	1	0.99001	0.99001	0.0001	0.0001	1
Total lbmol/h	5416.2495	11933.791	119.3739	11814.417	3350.9658	4705.0791	3758.3721	6517.541	5416.2495	9571.2314	9571.2314	890
Total lb/h	97573.7344	214987.234	2150.5205	212836.719	60367.6484	84762	67707.0703	117413.5	97573.7344	172425.734	172425.734	14278.2695
Total std L gpd	280606.28	618268.574	6184.5498	612083.992	173607.591	243761.801	194714.6	337662.253	280606.28	495868.518	495868.518	136873.311
Total std V scfh	2055350.88	4528618.5	45299.84	4483318.5	1271619.88	1785477	1426221.88	2473267.5	2055350.88	3632077.75	3632077.75	337735.97
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	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
Carbon Monoxide	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Methane	0	0	0	0	0	0	0	0	0	0	0	14278.2695
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	97573.7344	214987.234	2150.5205	212836.719	60367.6484	84762	67707.0703	117413.5	97573.7344	172425.734	172425.734	0
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	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
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	1602	1603	1604	1702	1748	1830	1831	1835	1836	1841	1842	1844
Stream Name			TO DRYER		TO SCRUBB	CWS		CWS		CWS		CWS
Temp F	84.5262	84.5262	84.5262	117.0121	110	90	110	90	110	90	110	90
Pres psia	15	15	15	324	416.5	60	60	60	60	65	65	65
Enth MMBtu/h	-127.24	-103.41	-23.83	-577.06	-1161	-20356	-20296	-2628.2	-2620.5	-4521.1	-4507.9	-3589.6
Vapor mole fraction	1	1	1	0	0	0	0	0	0	0	0	0
Total lbmol/h	2767.1084	2248.8884	518.2196	4733.457	9478.4102	165857.281	165857.25	21414.3848	21414.3809	36837.1992	36837.1992	29247.4531
Total lb/h	56066.2461	45566.2461	10500.001	85530.5391	171324.172	2987918.75	2987918.25	385780.125	385780.063	663622.125	663622.125	526893
Total std L gpd	350444.054	284813.416	65630.6125	246873.021	493287.651	8592771.93	8592769.96	1109441.29	1109441.13	1908469.95	1908469.95	1515258.74
Total std V scfh	1050058.5	853405.06	196653.27	1796245.75	3596854	62939292	62939280	8126301.5	8126300	13978930	13978930	11098783
Flowrates in lb/h												
Oxygen	0	0	0	0	0	0	0	0	0	0	0	0
Nitrogen	886.0067	720.0767	165.9299	0.0536	0.0007	0	0	0	0	0	0	0
Argon	154.1014	125.2416	28.8599	0.0282	0.0058	0	0	0	0	0	0	0
Carbon	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen	1376.1693	1118.4425	257.7269	1.0372	0.0476	0	0	0	0	0	0	0
Carbon Monoxide	11952.25	9713.8516	2238.3989	11.1789	0.1413	0	0	0	0	0	0	0
Carbon Dioxide	13022.6064	10583.7529	2438.8535	390.8133	966.7572	0	0	0	0	0	0	0
Methane	17888.332	14538.2324	3350.0989	2.7723	0.0516	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0.0458	0.0372	0.0086	1.1593	0	0	0	0	0	0	0	0
Ethane	0.0998	0.0811	0.0187	0.368	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	121.5658	98.7991	22.7666	84733.4063	170355.344	2987918.75	2987918.25	385780.125	385780.063	663622.125	663622.125	526893
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	0	0	0	0.2423	0	0	0	0	0	0	0	0
Ammonia	15.6738	12.7385	2.9354	321.0891	1.7752	0	0	0	0	0	0	0
HydrogenChloride	0	0	0	18.307	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	37.8094	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	12.2754	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0.0866	0.0704	0.0162	0	0.0001	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	4206.5806	3418.7788	787.8019	0	0.0443	0	0	0	0	0	0	0
Ethanol	238.6149	193.9275	44.6874	0	0	0	0	0	0	0	0	0
N-Propanol	0.1011	0.0821	0.0189	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	31.573	25.6601	5.9129	0	0	0	0	0	0	0	0	0
Acetic Acid	0.1607	0.1306	0.0301	0	0	0	0	0	0	0	0	0
Methyl Acetate	3611.082	2934.8042	676.2778	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0.0201	0.0163	0.0038	0	0	0	0	0	0	0	0	0
Methyl Iodide	2561.175	2081.5222	479.6529	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	1845	1850	1851	1930	1931	1935	1936	1938	1940	1941	1943	1944
Stream Name		CWS		STEAM		BFW	MP STEAM	TO STM DRI	STEAM	From 1957	SATD STEAI	MP STEAM
Temp F	105	90	110	715.0002	715.0002	230	400	574.7471	715.0002	456.588	573.2466	1000
Pres psia	65	65	60	450	450	1280	1280	1280	450	450	1265	1265
Enth MMBtu/h	-3581.7	-3059.8	-3050.8	-229.77	-229.77	-947.46	-922.21	-808.06	-282.63	-831.87	-1263.3	-1193.2
Vapor mole fraction	0	0	0	1	1	0	0	1	1	1	1	1
Total lbmol/h	29247.4551	24930.7363	24930.7344	2317.7219	2317.7219	7882.3203	7882.3203	7882.3203	2850.9299	8149.2935	12324.6191	12324.6191
Total lb/h	526893	449127.188	449127.156	41753.7578	41753.7578	142000	142000	142000	51359.5	146809.516	222028	222028
Total std L gpd	1515258.74	1291617.27	1291617.19	120077.064	120077.064	408369.026	408369.026	408369.026	147701.63	422200.438	638516.675	638516.675
Total std V scfh	11098784	9460682	9460681	879525.94	879525.94	2991172	2991172	2991172	1081867	3092482.75	4676929.5	4676929.5
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	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
Carbon Monoxide	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Methane	0	0	0	0	0	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	526893	449127.188	449127.156	41753.7578	41753.7578	142000	142000	142000	51359.5	146809.516	222028	222028
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	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
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	1947	1948	1949	1950	1952	1953	1954	1955	1956	1957	1958	1980
Stream Name	SAT'D STM		BFW	TO STM DRI	BFW			STEAM				
Temp F	573.2465	1000	230	574.747	226	456.586	456.586	715.0002	456.586	456.586	456.586	225
Pres psia	1265	1265	1280	1280	450	450	450	450	450	450	450	125
Enth MMBtu/h	-1422.5	-1343.5	-2233.8	-1905.2	-990.03	-841.4	-841.4	-181.2	-211.76	-831.87	-9.5254	-784.01
Vapor mole fraction	1	1	0	1	0	0.99001	0.99001	1	1.00E-06	1	0	0
Total lbmol/h	13877.3252	13877.3252	18584.2695	18584.2695	8231.5127	8231.5127	8231.5127	1827.821	1827.821	8149.2935	82.2193	6517.541
Total lb/h	250000	250000	334795.594	334795.594	148290.703	148290.703	148290.703	32928.1953	32928.1953	146809.516	1481.1799	117413.5
Total std L gpd	718959.593	718959.593	962818.068	962818.068	426460.074	426460.074	426460.074	94696.1653	94696.1653	422200.438	4259.6341	337662.253
Total std V scfh	5266148.5	5266148.5	7052333	7052333	3123683	3123683	3123683	693619	693619	3092482.75	31200.45	2473267.5
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	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
Carbon Monoxide	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Methane	0	0	0	0	0	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	250000	250000	334795.594	334795.594	148290.703	148290.703	148290.703	32928.1953	32928.1953	146809.516	1481.1799	117413.5
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	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
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	1981	1982	1983	1984	1985	1988	1989	1990	1991	1992	1993	1994
Stream Name												From 978
Temp F	345.1872	345.1872	342.1186	338.574	342.1185	90	100	225	342.1165	342.1165	276.0603	342.1186
Pres psia	125	125	120	115	120	65	60	125	120	120	35	120
Enth MMBtu/h	-667.88	-667.88	-342.86	-395.56	-481.23	-55330	-55185	-651.53	-555.1	-555.1	-596.4	-384.6
Vapor mole fraction	0.99001	0.99001	1	1.00E-06	1	0	0	0	0.99001	0.99001	1	1
Total lbmol/h	6517.541	6517.541	3350.5142	3350.5142	4702.7139	450815.125	450815.094	5416.2495	5416.2495	5416.2495	5812.8076	3758.4236
Total lb/h	117413.5	117413.5	60359.5117	60359.5117	84719.3906	8121434	8121433.5	97573.7344	97573.7344	97573.7344	104717.727	67708
Total std L gpd	337662.253	337662.253	173584.191	173584.191	243639.267	23355931.7	23355931.7	280606.28	280606.28	280606.28	301151.252	194717.266
Total std V scfh	2473267.5	2473267.5	1271448.5	1271448.5	1784579.38	171074704	171074688	2055350.88	2055350.88	2055350.88	2205836.25	1426241.38
Flowrates in lb/h												
Oxygen	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
Argon	0	0	0	0	0	0	0	0	0	0	0	0
Carbon	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
Carbon Monoxide	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Methane	0	0	0	0	0	0	0	0	0	0	0	0
Acetylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethylene	0	0	0	0	0	0	0	0	0	0	0	0
Ethane	0	0	0	0	0	0	0	0	0	0	0	0
Propane	0	0	0	0	0	0	0	0	0	0	0	0
Water	117413.5	117413.5	60359.5117	60359.5117	84719.3906	8121434	8121433.5	97573.7344	97573.7344	97573.7344	104717.727	67708
Sulphur	0	0	0	0	0	0	0	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide	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
HydrogenChloride	0	0	0	0	0	0	0	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0	0	0	0	0	0	0	0
Calcium Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Benzene	0	0	0	0	0	0	0	0	0	0	0	0
Naphthalene	0	0	0	0	0	0	0	0	0	0	0	0
Hybrid Poplar Ch	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
Hydrogen Cyanide	0	0	0	0	0	0	0	0	0	0	0	0
Nitric Oxide	0	0	0	0	0	0	0	0	0	0	0	0
Methanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Propanol	0	0	0	0	0	0	0	0	0	0	0	0
N-Butanol	0	0	0	0	0	0	0	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Acetic Acid	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Acetate	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Methyl Iodide	0	0	0	0	0	0	0	0	0	0	0	0
Propionic Acid	0	0	0	0	0	0	0	0	0	0	0	0

Stream No.	1995	1996	1997	1998	1999
Stream Name					
Temp F	287.5813	276.0603	250.4211	90	98.6
Pres psia	35	35	30	65	59.9594
Enth MMBtu/h	-980.99	-20.346	-23.736	-26187	-26124
Vapor mole fraction	1	1	1.00E-08	0	0
Total lbmol/h	9571.2314	198.3078	198.3078	213367	213367
Total lb/h	172425.734	3572.5144	3572.5144	3843804.75	3843804
Total std L gpd	495868.518	10273.9742	10273.9742	11054160.9	11054159.6
Total std V scfh	3632077.75	75253.56	75253.56	80968184	80968168
Flowrates in lb/h					
Oxygen	0	0	0	0	0
Nitrogen	0	0	0	0	0
Argon	0	0	0	0	0
Carbon	0	0	0	0	0
Hydrogen	0	0	0	0	0
Carbon Monoxide	0	0	0	0	0
Carbon Dioxide	0	0	0	0	0
Methane	0	0	0	0	0
Acetylene	0	0	0	0	0
Ethylene	0	0	0	0	0
Ethane	0	0	0	0	0
Propane	0	0	0	0	0
Water	172425.734	3572.5144	3572.5144	3843804.75	3843804
Sulphur	0	0	0	0	0
Carbonyl Sulfide	0	0	0	0	0
Hydrogen Sulfide	0	0	0	0	0
Ammonia	0	0	0	0	0
HydrogenChloride	0	0	0	0	0
Silicon Dioxide	0	0	0	0	0
Calcium Oxide	0	0	0	0	0
Benzene	0	0	0	0	0
Naphthalene	0	0	0	0	0
Hybrid Poplar Ch	0	0	0	0	0
Sulfur Dioxide	0	0	0	0	0
Hydrogen Cyanide	0	0	0	0	0
Nitric Oxide	0	0	0	0	0
Methanol	0	0	0	0	0
Ethanol	0	0	0	0	0
N-Propanol	0	0	0	0	0
N-Butanol	0	0	0	0	0
Ethyl Acetate	0	0	0	0	0
Acetic Acid	0	0	0	0	0
Methyl Acetate	0	0	0	0	0
Hydrogen Iodide	0	0	0	0	0
Methyl Iodide	0	0	0	0	0
Propionic Acid	0	0	0	0	0

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