

Outline of Significant Differences Between the Synapse Model and ANSS Model

In cell B6 we can see the single biggest and most influential difference between the two models in the capital cost estimates between Synapse and ESI. On a per MW basis this amounts to \$2.9 million/MW in the Synapse model and \$6.1/MW in the ANSS model.

The ANSS model also takes all "Value for Steam-Only Scenario" numbers and divides them in two prior to subtracting them from the "Gross Value for CHP Scenario" to reflect a sharing of the cost for production and use of the extraction steam from the plant. The Synapse model subtracts the full "Value for Steam-Only Scenario". This is a significant difference between the models.

Cell B11 and cell B13 related to Debt Closing Costs and Debt Service Reserve are not applicable to the ANSS model as we assume the project will be financed with 100% equity. The 100% equity financing assumption is again, another significant difference between the two models.

The plant under consideration in the ANSS model is 2.414MW in size compared with the Synapse model at 2.05MW. We have also chosen a higher capacity factor at 90% versus the Synapse model at 85%.

Cell F10 shows a significant difference in fuel requirements which is associated with the larger plant contemplated in the ANSS model, but also has to do with the fact that the ANSS model shares the fuel cost for the extraction steam, while the Synapse model allocates all extraction steam costs to the heat user.

Cell F12 demonstrates a significant difference in the Non fuel O&M expense primarily associated with some missing maintenance items, differences in labor calculations and the inclusion of parasitic power in the ANSS model.

Cell F26 indicates the sum of all of the differences between both models as reflected in the COMFIT price of \$339/MWh vs \$156/MWh.

Items that increase the COMFIT price in the ANSS model that should be noted and addressed:

1. The capital cost estimate for the boiler in the "Value of Steam Only Scenario" was an estimate from Synapse and we are comparing it to the ESI CHP plant estimate. Synapse had estimated the CHP plant cost at approximately half of the ESI estimate and therefore it is possible that Synapse has underestimated the capital cost of the boiler as well. If the capital cost of the boiler was determined to be higher based on an assessment by ESI then this would have a reducing affect on the rate in a number of areas that are calculated based on the capital cost. This effect could be fairly significant to the rate.

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2. The following O&M costs were not addressed in the Synapse model, but were included in the ESI assessment;

Ash Disposal
Raw Water
Sewer
Water Treatment
Parasitic Power

The value of these O&M costs needs to be determined for the "Value of Steam Only Scenario" to adequately account for these expenses. Once these values have been determined it will drop the proposed price.

3. We are also comparing Synapse's estimates of maintenance in the boiler only scenario with ESI's CHP estimates. A more equal comparison would be comparing ESI's boiler maintenance estimates with ESI's CHP estimates.
4. If ESI performed a study to determine the capital cost and O&M costs for an 18,000 pph boiler than one could address all of the above issues.

Nova Scotia COMFIT Model

Biomass CHP (condensing turbine; new boiler in steam-only scenario in year 10)

Assumptions		Notes:
General Inflation Factor (revenue and expenses)		1.92% From NSPI 2009 IRP Update
Capital Costs (Uses of Funds)		
Development	238,146	Net of steam-only scenario
Equipment & Installation	14,801,747	Net of steam-only scenario
Interconnection	199,000	Net of steam-only scenario
Reserves		
Up-Front Maintenance	68,618	Net of steam-only scenario
Working Capital	936,012	Net of steam-only scenario
Debt Service Reserve	0	Net of steam-only scenario
Financing		
Debt Closing Costs & Fees	0	Net of steam-only scenario
Equity Closing Costs & Fees	640,981	Net of steam-only scenario
Interest During Construction	785,989	Net of steam-only scenario
Total Project Cost	17,670,493	Net of steam-only scenario
Total Project Cost (\$/kW)	7,320	Net of steam-only scenario
Initial Reserve Account Sizing		
Upfront Maintenance (months of Year 1 O&M)	6	
Working Capital (months of Year 1 OPEX)	6	
Debt Service Reserve (months of P&I)	6	
Capital Structure (Sources of Funds)		
Amount (\$)		
Grants (net value)	0	
Debt	0	
Equity	17,670,493	
Total Sources of Funds	17,670,493	
Amount (%)		
Grants	0.0%	
Debt	0.0%	
Equity	100.0%	
Total Sources of Funds	100.0%	
Grants:		
State and Federal Incentives	0	
State/Provincial Tax 1	0	
State/Provincial Tax 2	0	
Federal tax	0	
Net Value of Grants	0	
Debt Terms		
Amount	0	(Based on target debt/equity ratio)
Loan Life	15	
Interest Rate	9.50%	
Up-Front Fee (%)	1.00%	
Up-Front Fee (\$)	0	
Closing Costs	0	(5% of loan value)
Tax Depreciation Allocation		
% of Total Project Cost		
30% Double Declining	0.0%	
50% Double Declining	79.6%	95% of equipment and installation
20-yr SL	0.0%	
40-yr SL	0.0%	
Other	0.0%	
Non-Depreciable	20.42%	Interconnection, development, reserves and financing
Total	100.0%	
Amount Allocated		
30% Double Declining	0	
50% Double Declining	14,061,659	
20-yr SL	0	
40-yr SL	0	
Other	0	
Non-Depreciable	3,608,834	
Total	17,670,493	
Year One Depreciation		
Year One Percent	25.0%	(Based on the "half year rule")
Year One Amount	3,515,415	

Assumptions:		Notes:
Operating Inputs		
Gross Generator Capacity (MW)	2,414	1,602 MW at full extraction, 2,414 MW at full condensing
Energy Production:		
Gross Capacity Factor		60% of time at full extraction, another 30% at full condensing
Gross Output in MWhs	14,764	
Annual Operating Expenses		
Annual Fuel Cost		
Fuel Required per Year (mmBtu)	251,657	Net of steam-only scenario
Initial year Fuel Price (\$/mmBtu)	\$4.24	
Annual O&M (expensed)	705,037	Escalates at inflation.
Site Maintenance	0	Escalates at inflation.
General & Administrative	0	Escalates at inflation.
Insurance	75,907	Escalates at inflation.
Land Lease	0	Escalates at inflation.
Other	0	Escalates at inflation.
Property Tax		
Project Hard Costs	14,801,747	
Assessed Value (%)	0.68%	Machinery and equipment is not assessed.
Assessed Value (\$)	100,000	
Annual Decline in Assessed Value	1.00%	
Assessed Value Minimum %	0.00%	
Property Tax Rate	3.50%	
Revenue Assumptions		
Levelized Energy Price (\$/MWh)	339.00	
% of Levelized Rate Escalating @ Infl.	0.0%	
Other Revenues (increases with inflation)	0	
Return Metrics		
20-year Equity IRR		
Pre-Tax	15.81%	
After-Tax	12.96%	
Average Debt Service Coverage Ratio	#DIV/0!	
Minimum Debt Service Coverage Ratio	#DIV/0!	
Minimum Annual After-Tax Equity Net Benefits	1,715,458	Includes tax benefit/(liability)
Tax Rates:		
Federal Income Tax	15.0%	
State/Provincial Income Tax		
Tax Rate 1		
Applicable Income (less than X)	400,000	
Tax Rate 1	4.5%	
Tax Rate 2 (for income greater than X)	16.0%	
Major Maintenance		
Replacement Occurs Every X Years	11	
Cost of Replacement (Year 0 Dollars)	356,720	
	50% Double	
Tax Depreciation Classification of Spending	Declining	
Book Depreciation Classification of Spending	30-yr SL	
Residual Value		
Residual Value (Net Book Value)	421	
Book Depreciation Classifications		
20-yr SL	100.0%	
30-yr SL	0.0%	
37-yr SL	0.0%	
40-yr SL	0.0%	
Non-Depreciable	0.00%	
Total	100.0%	
Amount Allocated		
20-yr SL	17,670,493	
30-yr SL	0	
37-yr SL	0	
40-yr SL	0	
Non-Depreciable	0	
Total	17,670,493	

Operating Year

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Iowa Scotia COMFIT Model

Operating Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Total	1,004,630	1,004,630	1,004,630	1,004,630	1,004,630	1,004,630	1,004,630	1,004,630	1,004,630	1,004,630	1,004,630	1,004,630	1,004,630	1,004,630	1,004,630	1,004,630	1,004,630	1,004,630	1,004,630	1,004,630	0
Maintenance Reserve Funded Through Operations																					
Beginning Balance		0	39,222	78,444	117,666	156,888	196,110	235,332	274,553	313,775	352,997	392,219	0	0	0	0	0	0	0	0	0
Funding		39,222	39,222	39,222	39,222	39,222	39,222	39,222	39,222	39,222	39,222	39,222	0	0	0	0	0	0	0	0	0
Release of Funds		0	0	0	0	0	0	0	0	0	0	(431,441)	0	0	0	0	0	0	0	0	0
Ending Balance		39,222	78,444	117,666	156,888	196,110	235,332	274,553	313,775	352,997	392,219	0	0	0	0	0	0	0	0	0	0
Major Maintenance Costs																					
Occurrence 1	431,441	0	0	0	0	0	0	0	0	0	0	431,441	0	0	0	0	0	0	0	0	0
Occurrence 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Occurrence 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Occurrence 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Major Maintenance Funding																					
Occurrence 1	431,441	39,222	39,222	39,222	39,222	39,222	39,222	39,222	39,222	39,222	39,222	39,222	0	0	0	0	0	0	0	0	0
Occurrence 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Occurrence 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Occurrence 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interest on Reserves		19,289	20,042	20,795	21,548	22,301	23,054	23,807	24,560	25,313	26,066	26,820	19,289	19,289	19,289	19,289	19,289	19,289	19,289	19,289	19,289
Property Tax Calculation																					
Original Assessed Value	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Annual Decline in Assessed Value	100.0%	99.0%	98.0%	97.0%	96.0%	95.0%	94.0%	93.0%	92.0%	91.0%	90.0%	89.0%	88.0%	87.0%	86.0%	85.0%	84.0%	83.0%	82.0%	81.0%	
Annual Assessed Value	100,000	99,000	98,000	97,000	96,000	95,000	94,000	93,000	92,000	91,000	90,000	89,000	88,000	87,000	86,000	85,000	84,000	83,000	82,000	81,000	
Property Tax Rate	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%
Property Tax Expense	3,500	3,465	3,430	3,395	3,360	3,325	3,290	3,255	3,220	3,185	3,150	3,115	3,080	3,045	3,010	2,975	2,940	2,905	2,870	2,835	

Nova Scotia COMFIT Model

Operating Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Calendar Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
Tax Depreciation																						
Calendar Year Depreciation per Classification (%)																						
30% Double Declining		30.00%	21.00%	14.70%	10.29%	7.20%	5.04%	3.53%	2.47%	1.73%	1.21%	0.85%	0.59%	0.42%	0.29%	0.20%	0.14%	0.10%	0.07%	0.05%	0.03%	
50% Double Declining		50.00%	25.00%	12.50%	6.25%	3.13%	1.56%	0.78%	0.39%	0.20%	0.10%	0.05%	0.02%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
20-yr SL		2.50%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	
40-yr SL		1.25%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	
Other		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	
Calendar Year Depreciation per Classification (\$)																						
Year One Capital Cost Allocation	3,515,415	3,515,415	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
30% Double Declining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
50% Double Declining	10,546,245	0	5,273,122	2,636,561	1,318,281	659,140	329,570	164,785	82,393	41,196	20,598	10,299	5,150	2,575	1,287	644	322	161	80	40	20	
20-yr SL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
40-yr SL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Major Maintenance												215,721	107,860	53,930	26,965	13,483	6,741	3,371	1,685	843	421	
Annual Depreciation	14,492,659	3,515,415	5,273,122	2,636,561	1,318,281	659,140	329,570	164,785	82,393	41,196	20,598	226,020	113,010	56,505	28,252	14,126	7,063	3,532	1,766	883	441	
Major Maintenance																						
Timing of Spending																						
Occurrence 1		0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	
Occurrence 2		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Occurrence 3		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Occurrence 4		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Depreciation Classification																						
Year	50% Double Declining	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Depreciation Schedule		0.00%	50.00%	25.00%	12.50%	6.25%	3.13%	1.56%	0.78%	0.39%	0.20%	0.10%	0.05%	0.02%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	
Depreciation Expense																						
	Expense	Depreciation Amount																				
Occurrence 1	431,441	431,020	0	0	0	0	0	0	0	0	0	215,721	107,860	53,930	26,965	13,483	6,741	3,371	1,685	843	421	
Occurrence 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Occurrence 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Occurrence 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Book Depreciation																						
Calendar Year Depreciation per Classification (%)																						
20-yr SL		5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	
30-yr SL		3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	
37-yr SL		2.70%	2.70%	2.70%	2.70%	2.70%	2.70%	2.70%	2.70%	2.70%	2.70%	2.70%	2.70%	2.70%	2.70%	2.70%	2.70%	2.70%	2.70%	2.70%	2.70%	
40-yr SL		2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	
Calendar Year Depreciation per Classification (\$)																						
20-yr SL	17,670,493	883,525	883,525	883,525	883,525	883,525	883,525	883,525	883,525	883,525	883,525	883,525	883,525	883,525	883,525	883,525	883,525	883,525	883,525	883,525	883,525	
30-yr SL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
37-yr SL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
40-yr SL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Major Maintenance												215,721	107,860	53,930	26,965	13,483	6,741	3,371	1,685	843	421	
Annual Depreciation	18,101,513	883,525	883,525	883,525	883,525	883,525	883,525	883,525	883,525	883,525	883,525	1,099,245	991,385	937,455	910,490	897,007	890,266	886,895	885,210	884,367	883,946	
Major Maintenance																						
Timing of Spending																						
Occurrence 1		0	0	0	0	0	0	0	0	0	0	1	2	3	4	5	6	7	8	9	10	
Occurrence 2		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Occurrence 3		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Occurrence 4		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Depreciation Classification																						
Year	30-yr SL	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Depreciation Schedule		0.00%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	
Depreciation Expense																						
	Expense	Depreciation Amount																				
Occurrence 1	431,441	431,020	0	0	0	0	0	0	0	0	0	215,721	107,860	53,930	26,965	13,483	6,741	3,371	1,685	843	421	
Occurrence 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Occurrence 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Occurrence 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Net Book Value																						
Beginning Balance	0	16,786,969	15,903,444	15,019,919	14,136,395	13,252,870	12,369,345	11,485,821	10,602,296	9,718,771	8,835,247	8,167,443	7,176,058	6,238,603	5,328,113	4,431,106	3,540,840	2,653,945	1,768,735	884,367		
Original Book Value	17,670,493	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Plus: Major Maintenance												431,441	0	0	0	0	0	0	0	0		
Less: Depreciation		(883,525)	(883,525)	(883,525)	(883,525)	(883,525)	(883,525)	(883,525)	(883,525)	(883,525)	(883,525)	(1,099,245)	(991,385)	(937,455)	(910,490)	(897,007)	(890,266)	(886,895)	(885,210)	(884,367)	(883,946)	
Net Book Value	16,786,969	15,903,444	15,019,919	14,136,395	13,252,870	12,369,345	11,485,821	10,602,296	9,718,771	8,835,247	8,167,443	7,176,058	6,238,603	5,328,113	4,431,106	3,540,840	2,653,945	1,768,735	884,367	421		

Biomass CHP Cost Scenarios

Scenarios in \$2012

Component	Value for Steam-Only Scenario	Shared Value Steam Only Scenario	Gross Value for CHP Scenario	Net Value for CHP Scenario
Project development	\$42,134		\$280,280	\$238,146
Boiler installed cost (\$)	\$1,685,370		\$0	-\$1,685,370
Turbine installed cost (\$)	\$0		\$0	\$0
Emission controls	\$252,806		\$0	-\$252,806
Condenser/Cooling Tower	\$0		\$0	\$0
Equipment and Installation (\$)	\$1,938,176	\$969,088	\$16,150,398	\$14,801,747
Interconnection (\$)	\$0		\$199,000	\$199,000
Maintenance reserve (\$)	\$65,279	\$32,639	\$101,258	\$68,618
Working capital reserve (\$)	\$433,934		\$1,152,979	\$936,012
Debt service reserve (\$)	\$213,498		\$0	\$0
Debt Closing Costs & Fees	\$109,646		\$0	\$0
Equity Closing Costs & Fees	\$48,718	\$24,359	\$665,340	\$640,981
Interest During Construction	\$91,371	\$45,686	\$831,675	\$785,989
Routine Maintenance (\$/yr)	\$130,557	\$65,279	\$202,515	\$137,236
Ash Disposal	not in Synapse model		\$5,718	\$5,718
Raw Water	not in Synapse model		\$32,495	\$32,495
Sewer	not in Synapse model		\$1,096	\$1,096
Water Treatment	not in Synapse model		\$90,398	\$90,398
Labour (\$)	\$40,768	\$20,384	\$218,904	\$198,520
Parasitic Power	not in Synapse model		\$239,573	\$239,573
General & Admin.	\$0		\$0	\$0
Insurance	\$9,691	\$4,845	\$80,752	\$75,907
Property taxes	\$0		\$3,567	
Year-10 Turbine overhaul (\$)	\$0		\$152,880	\$152,880
Year-10 Boiler overhaul (\$)	\$0		\$203,840	\$203,840
Annual Fuel Use (mmBtu/yr)	158,941	79,471	331,128	251,657
Annual Fuel Cost (\$/yr)	\$686,851	\$343,425	\$1,430,939	\$1,087,514
NPV of new boiler(\$2M) in yr 10	\$1,685,370			
Steam Load (mmBtu/hr)	30.24		42	
Boiler size (lb/hr)	18,000		25,000	
Boiler rating (psi)	15	15	600	
Turbine type	N/A		Condensing	
Turbine size (MW)	N/A		2.414	
Total Project Costs (\$)	\$2,942,755		\$19,380,930	\$17,670,493
Total Project Costs (\$/kW)			\$8,029	\$7,320

Actual Loan Value:	\$1,765,653	\$0
Actual Equity Amount:	\$1,177,102	\$19,380,930

Scenarios in \$2011

year 10

Component	Value for Steam-Only Scenario	Shared Value Steam- Only Scenario	Gross Value for CHP Scenario	Net Value for CHP Scenario
Project development	\$41,341		\$275,000	
Boiler installed cost (\$)	\$1,653,620		\$0	
Turbine installed cost (\$)	\$0		\$0	
Emission controls	\$248,043		\$0	
Condenser/Cooling Tower	\$0		\$0	
Equipment and Installation (\$)	\$1,901,664	\$950,832	\$15,846,152	\$14,522,907
Interconnection (\$)	\$0		\$199,000	\$199,000
Maintenance reserve (\$)	\$64,049	\$32,024	\$99,350	\$67,326
Working capital reserve (\$)	\$425,759		\$1,131,259	\$918,379
Debt service reserve (\$)	\$209,476		\$0	\$0
Debt Closing Costs & Fees	\$107,580		\$0	\$0
Equity Closing Costs & Fees	\$47,800	\$23,900	\$652,806	\$628,906
Interest During Construction	\$89,650	\$44,825	\$816,008	\$771,183
Routine Maintenance (\$/yr)	\$128,098	\$64,049	\$198,700	\$134,651
Ash Disposal	not in Synapse model		\$5,610	\$5,610
Raw Water	not in Synapse model		\$31,883	\$31,883
Sewer	not in Synapse model		\$1,076	\$1,076
Water Treatment	not in Synapse model		\$88,695	\$88,695
Labour (\$)	\$40,000	\$20,000	\$214,780	\$194,780
Parasitic Power	not in Synapse model		\$235,060	\$235,060
General & Admin.	\$0	\$0	\$0	\$0
Insurance	\$9,508	\$4,754	\$79,231	\$74,477
Property taxes	\$0		\$3,500	\$3,500
Year-10 Turbine overhaul (\$)	\$0		\$150,000	
Year-10 Boiler overhaul (\$)	\$0		\$200,000	
Annual Fuel Use (mmBtu/yr)	158,941	79,471	331,128	251,657
Annual Fuel Cost (\$/yr)	\$673,912	\$336,956	\$1,403,983	\$1,067,027
NPV of new boiler(\$2M) in yr 10	\$1,653,620.49			
Steam Load (mmBtu/hr)	30.24		42	
Boiler size (lb/hr)	18,000		25,000	
Boiler rating (psi)	15	15	600	
Turbine type	N/A		Condensing	
Turbine size (MW)	N/A		2.414	
Loan value for calculations:	\$1,793,000		\$0	
Equity amount for calculations:	\$1,195,000		\$16,320,152	\$14,522,907
Actual Loan Value:	\$1,732,391			
Actual Equity Amount:	\$1,154,927			

Plant Operating Parameters	
Plant Gross Capacity Full Condensing Mode (MW)	2.414
Plant Gross Capacity Under Maximum Extraction (MW)	1.602
Boiler Steam Production (lbs/hr)	25,000
Boiler Steam Pressure (psig)	600
Turbine Inlet Pressure (psig)	590
Process Heat Steam Flow	18,000
Process Steam Extraction Pressure (psig)	20
Boiler Heat Input (btu/hr)	42,000,000
Plant Heat Rate Full Condensing (btu/kWh)	17,399
Plant Heat Rate Max. Extraction (btu/kWh)	26,217
Plant Capacity Factor	90.00%

Plant Electricity Generation	
Condensing Mode	
Plant Gross Capacity Condensing Mode (MW)	2.414
Time in Condensing Mode (%)	30.00%
Annual Hours Operation in Full Condensing (hrs)	2,628
Gross Power Produced (MWh/yr)	6,344
Max. Extraction Mode	
Plant Gross Capacity Full Extraction (MW)	1.6020
Time in Full Extraction Mode (%)	60.00%
Annual Hours Operation under Max. Extraction (hrs)	5,256
Gross Power Produced Max. Extraction (MWh/yr)	8,420
Total Gross Power Produced for Sale (MWh/yr)	14,764

Parasitic Power	
Item	CHP Plant
Parasitic Power Requirement (%)	14.00%
Parasitic Power Requirement (MW)	0.33796
Parasitic Power Requirement (MWh/yr)	2,664
Capacity Required (kW)	338
Purchased Electricity Cost from NSPI (\$/MWh)	88.22
Cost of Parasitic Power (\$/yr)	\$235,060

Fuel Requirements	
Heat Value of Wood @ 50% moisture content (btu/ton)	8,600,000
Capacity Factor (%)	90.00%
Gross Energy Required (Mmbtu/hr) for 25,000 lbs/hr steam flow	42,000,000
Annual Hours of Plant Operation (hrs/year)	7884
Gross Energy Required for 25,000 lbs/hr steam flow (btu/yr)	331,128,000,000
Fuel Required (tons/yr)	38,503
Fuel Requirements for Shared Portion of Steam	
Shared Steam Flow or Extraction Steam Flow (lbs/hr)	18,000
Gross Energy Required for 18,000 lbs/hr steam flow (Mmbtu/hr)	30,240,000
Hours at extraction steam flow (hrs/yr)	5,256
Gross Energy Required for Extraction Portion Steam (btu/yr)	158,941,440,000
Total Wood Required to Supply 18,000 lbs/hr steam flow (tons/yr)	18,482

Biomass CHP Capital Cost Estimate				
	BREAKDOWN	EQUIP \$	LABOR \$	TOTAL \$
1	SITework	\$30,861	\$0	\$30,861
2	CONCRETE AND FOUNDATIONS	\$442,060	\$0	\$442,060
3	PLUMBING & SITE SEWER	\$19,500	\$0	\$19,500
4	MASONRY	\$0	\$0	\$0
5	STEEL, PLATFORMS, GRATING, ETC.	\$437,610	\$222,600	\$660,210
6	HVAC	\$23,000	\$24,000	\$47,000
7	PRE-ENG BUILDINGS, BLDG TRIM & MISC.	\$270,206	\$126,150	\$396,356
8	PAINTING & FINISHES	\$70,821	\$0	\$70,821
9	FIRE PROTECTION SYSTEMS	\$38,490	\$52,200	\$90,690
10	STEAM GENERATION SYSTEMS	\$1,430,000	\$288,000	\$1,718,000
11	BURNER FIRING SYSTEMS	\$85,000	\$0	\$85,000
12	FANS	\$84,441	\$45,600	\$130,041
13	EMISSIONS CONTROL SYSTEMS	\$578,000	\$180,000	\$758,000
14	FUEL HANDLING SYSTEMS (Receiving & Storage)	\$385,020	\$14,400	\$399,420
15	FUEL HANDLING SYSTEMS (Conveying)	\$406,600	\$168,000	\$574,600
16	FUEL HANDLING SYSTEMS (Misc)	\$102,705	\$39,000	\$141,705
17	ASH HANDLING SYSTEMS	\$0	\$30,000	\$30,000
18	WATER TREATMENT	\$145,250	\$44,400	\$189,650
19	STORAGE TANKS	\$57,385	\$21,000	\$78,385
20	MISC. AUXILIARY SYSTEMS	\$49,500	\$28,200	\$77,700
21	PUMPING SYSTEMS	\$166,864	\$21,600	\$188,464
22	HOPPERS, FLUES, DUCTS, ETC.	\$139,735	\$129,000	\$268,735
23	STEAM PLANT PIPING & VALVES	\$147,675	\$354,362	\$502,037
24	INSULATION & LAGGING	\$19,990	\$27,332	\$47,322
25	ELECTRICAL EQUIPMENT	\$191,993	\$298,473	\$490,466
26	CONTROL SYSTEMS	\$434,260	\$258,750	\$693,010
27	INSTRUMENTATION	\$251,515	\$64,275	\$315,790
28	GENERATING SYSTEMS	\$3,426,500	\$285,600	\$3,712,100
29	CONSTRUCTION EXPENSES	\$594,138	\$0	\$594,138
30	ENGINEERING, START-UP, AND COMMERCIAL	\$57,450	\$0	\$57,450

Subtotal Construction (Equip/Mat - Labor)	\$	10,086,568	\$	2,722,941	\$	12,809,510
Contingency - CONST	\$	504,328	\$	272,294		
Construction Cost TOTAL	\$	13,586,132				

Engineering/Project Management/Overhead	\$	715,060
Construction Management	\$	277,268
Profit (8%)	\$	1,267,692
ENG/PM/CM/OH Cost	\$	2,260,020

BUDGET PRICE	\$	15,846,152
Budget Accuracy (±%)		20%

Interconnection	\$	199,000
Total Budget Price	\$	16,045,152

Boiler Only	Shared Cost of Boiler	Portion of Cost to Electricity
\$0	\$0	\$30,861
\$0	\$0	\$442,060
\$0	\$0	\$19,500
\$0	\$0	\$0
\$0	\$0	\$660,210
\$0	\$0	\$47,000
\$0	\$0	\$396,356
\$0	\$0	\$70,821
\$0	\$0	\$90,690
\$1,653,620	\$826,810	\$891,190
\$0	\$0	\$85,000
\$0	\$0	\$130,041
\$248,043	\$124,022	\$633,978
\$0	\$0	\$399,420
\$0	\$0	\$574,600
\$0	\$0	\$141,705
\$0	\$0	\$30,000
\$0	\$0	\$189,650
\$0	\$0	\$78,385
\$0	\$0	\$77,700
\$0	\$0	\$188,464
\$0	\$0	\$268,735
\$0	\$0	\$502,037
\$0	\$0	\$47,322
\$0	\$0	\$490,466
\$0	\$0	\$693,010
\$0	\$0	\$315,790
\$0	\$0	\$3,712,100
\$0	\$0	\$594,138
\$0	\$0	\$57,450

\$11,858,678
\$592,934
\$12,451,612
\$655,348
\$254,115
\$1,161,833
\$2,071,295
\$14,522,907

\$0	\$0	\$199,000
\$1,901,664	\$950,832	\$14,721,907