

Undertaking: U-10

Provide the recommended ANSS rate for biomass CHP

As noted in Exhibit B-15, the capital cost estimate, parasitic power and other non-O&M items in the “Value of Steam Only Scenario” were omitted or underestimated. Fully accounting for these has the effect of reducing the rate because of the netting approach [CHP – boiler only scenario]. The ANSS has made a high level estimate of the boiler capital cost for a “boiler only scenario” at \$4,640,930 compared with the Synapse estimate of \$1,901,664. We also included parasitic load at a cost of \$150,929 compared to a 0\$ estimate from Synapse. Other O&M items such as Ash Disposal, Raw Water, Sewer and Water Treatment were added, but had a minor effect on the rate. The revised numbers by ESI result in a final rate of \$320/MWh. The modeling is attached as U-1, Attachment.

Nova Scotia COMFIT Model

Assumptions		Notes:
General Inflation Factor (revenue and expenses)	1.92%	From NSPI 2009 IRP Update
Capital Costs (Uses of Funds)		Net of steam-only scenario
Development	238,146	Net of steam-only scenario
Equipment & Installation	13,785,380	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	889,991	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	16,608,105	Net of steam-only scenario
Total Project Cost (\$/kW)	6,880	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	16,608,105	
Total Sources of Funds	16,608,105	
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	78.9%	95% of equipment and installation
20-yr SL	0.0%	
40-yr SL	0.0%	
Other	0.0%	
Non-Depreciable	21.15%	
Total	100.0%	Interconnection, development, reserves and financing
Amount Allocated		
30% Double Declining	0	
50% Double Declining	13,096,111	
20-yr SL	0	
40-yr SL	0	
Other	0	
Non-Depreciable	3,511,994	
Total	16,608,105	
Year One Depreciation		
Year One Percent	25.0%	(Based on the "half year rule")
Year One Amount	3,274,028	

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

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 MWhrs	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)	619,974	Escalates at inflation.
Site Maintenance	0	Escalates at inflation.
General & Administrative	0	Escalates at inflation.
Insurance	68,927	Escalates at inflation.
Land Lease	0	Escalates at inflation.
Other	0	Escalates at inflation.
Property Tax		
Project Hard Costs	13,785,380	
Assessed Value (%)	0.73%	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)	320.00	
% of Levelized Rate Escalating @ Infl.	0.0%	
Other Revenues (increases with inflation)	0	
Return Metrics		
20-year Equity IRR		
Pre-Tax	15.79%	
After-Tax	12.93%	
Average Debt Service Coverage Ratio	#DIV/0!	
Minimum Debt Service Coverage Ratio	#DIV/0!	
Minimum Annual After-Tax Equity Net Benefits	1,610,725	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	16,608,105	
30-yr SL	0	
37-yr SL	0	
40-yr SL	0	
Non-Depreciable	0	
Total	16,608,105	

Nova Scotia COMFIT Model

Operating Year		0	1	2	3	4	5	6	7	8	9	10	11	12	
Generation (MWh)			14,764	14,764	14,764	14,764	14,764	14,764	14,764	14,764	14,764	14,764	14,764	14,764	
Partial Income Statement															
Revenue															
Standard Offer Price (\$/MWh)															
Fixed Price Component	100%		320.00	320.00	320.00	320.00	320.00	320.00	320.00	320.00	320.00	320.00	320.00	320.00	
Escalating Price Component	0%		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Standard Offer Price			320.00	320.00	320.00	320.00	320.00	320.00	320.00	320.00	320.00	320.00	320.00	320.00	
Revenues From Energy Production			4,724,513	4,724,513	4,724,513	4,724,513	4,724,513	4,724,513	4,724,513	4,724,513	4,724,513	4,724,513	4,724,513	4,724,513	
Other Revenues			0	0	0	0	0	0	0	0	0	0	0	0	
Interest Revenue			18,405	19,158	19,911	20,664	21,418	22,171	22,924	23,677	24,430	25,183	25,936	18,405	
Total Revenue			4,742,919	4,743,672	4,744,425	4,745,178	4,745,931	4,746,684	4,747,437	4,748,190	4,748,943	4,749,696	4,750,449	4,742,919	
Expenses															
Fuel Cost			(1,067,027)	(1,087,514)	(1,108,394)	(1,129,675)	(1,151,365)	(1,173,471)	(1,196,002)	(1,218,965)	(1,242,369)	(1,266,223)	(1,290,534)	(1,315,312)	
O&M			(619,974)	(631,877)	(644,009)	(656,374)	(668,977)	(681,821)	(694,912)	(708,254)	(721,853)	(735,712)	(749,838)	(764,235)	
Site Maintenance			0	0	0	0	0	0	0	0	0	0	0	0	
G&A			0	0	0	0	0	0	0	0	0	0	0	0	
Insurance			(68,927)	(70,250)	(71,599)	(72,974)	(74,375)	(75,803)	(77,258)	(78,742)	(80,254)	(81,794)	(83,365)	(84,965)	
Land Lease			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	
Property tax			(3,500)	(3,465)	(3,430)	(3,395)	(3,360)	(3,325)	(3,290)	(3,255)	(3,220)	(3,185)	(3,150)	(3,115)	
Total			(1,759,428)	(1,793,106)	(1,827,432)	(1,862,418)	(1,898,077)	(1,934,420)	(1,971,462)	(2,009,216)	(2,047,696)	(2,086,914)	(2,126,887)	(2,167,628)	
EBITDA			2,983,491	2,950,565	2,916,992	2,882,759	2,847,854	2,812,264	2,775,975	2,738,974	2,701,248	2,662,782	2,623,562	2,575,291	
Equity Return															
Cash															
EBITDA			2,983,491	2,950,565	2,916,992	2,882,759	2,847,854	2,812,264	2,775,975	2,738,974	2,701,248	2,662,782	2,623,562	2,575,291	
Plus: Release of Debt Service Reserve			0	0	0	0	0	0	0	0	0	0	0	0	
Plus: Release of WC & Up-Front Maint Reserves			0	0	0	0	0	0	0	0	0	0	0	0	
Plus: Release of Major Maintenance Reserves			0	0	0	0	0	0	0	0	0	0	431,441	0	
Plus: Residual Value			0	0	0	0	0	0	0	0	0	0	0	0	
Less: Major Maintenance Spending			0	0	0	0	0	0	0	0	0	0	(431,441)	0	
Less: Major Maintenance Reserve Funding			(39,222)	(39,222)	(39,222)	(39,222)	(39,222)	(39,222)	(39,222)	(39,222)	(39,222)	(39,222)	(39,222)	0	
Less: Principal			0	0	0	0	0	0	0	0	0	0	0	0	
Less: Interest			0	0	0	0	0	0	0	0	0	0	0	0	
Total Cash			2,944,269	2,911,343	2,877,770	2,843,538	2,808,632	2,773,042	2,736,753	2,699,752	2,662,026	2,623,560	2,584,340	2,575,291	
Equity Investment			(16,608,105)												
Total Pre-Tax Equity Return			(16,608,105)	2,944,269	2,911,343	2,877,770	2,843,538	2,808,632	2,773,042	2,736,753	2,699,752	2,662,026	2,623,560	2,584,340	2,575,291
Pre-Tax Internal Rate of Return		15.79%													
Taxable Income Benefit/(Liability)															
EBITDA			2,983,491	2,950,565	2,916,992	2,882,759	2,847,854	2,812,264	2,775,975	2,738,974	2,701,248	2,662,782	2,623,562	2,575,291	
Less: Interest			0	0	0	0	0	0	0	0	0	0	0	0	
Less: Tax Depreciation			(3,274,028)	(4,911,042)	(2,455,521)	(1,227,760)	(613,880)	(306,940)	(153,470)	(76,735)	(38,368)	(19,184)	(225,312)	(112,656)	
Taxable Income/(Loss)			(290,537)	(1,960,476)	461,471	1,654,999	2,233,974	2,505,324	2,622,505	2,662,239	2,662,880	2,643,598	2,398,250	2,462,635	
Tax Benefit/(Liability)															
State/Provincial 1			13,074	18,000	(18,000)	(18,000)	(18,000)	(18,000)	(18,000)	(18,000)	(18,000)	(18,000)	(18,000)	(18,000)	
State/Provincial 2			0	249,676	(9,835)	(200,800)	(293,436)	(336,852)	(355,601)	(361,958)	(362,061)	(358,976)	(319,720)	(330,022)	
Federal			43,581	294,071	(69,221)	(248,250)	(335,096)	(375,799)	(393,376)	(399,336)	(399,432)	(396,540)	(359,737)	(369,395)	
Total Tax Benefit/(Liability)			56,655	561,748	(97,056)	(467,050)	(646,532)	(730,650)	(766,976)	(779,294)	(779,493)	(773,515)	(697,457)	(717,417)	
Equity Investment			(16,608,105)												
Total After-Tax Equity Return			(16,608,105)	3,000,924	3,473,091	2,780,714	2,376,488	2,162,100	2,042,391	1,969,776	1,920,458	1,882,533	1,850,044	1,886,883	1,857,874
After-Tax Internal Rate of Return		12.93%													
Debt															
Loan Balance		0	0	0	0	0	0	0	0	0	0	0	0	0	
Interest	9.50%	0	0	0	0	0	0	0	0	0	0	0	0	0	
Principal		0	0	0	0	0	0	0	0	0	0	0	0	0	
Annual payment			0	0	0	0	0	0	0	0	0	0	0	0	
Debt Service Coverage Ratio															
EBITDA			2,983,491	2,950,565	2,916,992	2,882,759	2,847,854	2,812,264	2,775,975	2,738,974	2,701,248	2,662,782	2,623,562	2,575,291	
Less: Major Maintenance Reserve Funding			(39,222)	(39,222)	(39,222)	(39,222)	(39,222)	(39,222)	(39,222)	(39,222)	(39,222)	(39,222)	(39,222)	0	
Cash Available for Debt Service			2,944,269	2,911,343	2,877,770	2,843,538	2,808,632	2,773,042	2,736,753	2,699,752	2,662,026	2,623,560	2,584,340	2,575,291	
P&I			0	0	0	0	0	0	0	0	0	0	0	0	
Debt Service Coverage Ratio			#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	
Average		#DIV/0!													
Minimum		#DIV/0!													
Reserve Accounts															
Reserves Funded As Part of Capital Cost															
Beginning Balance	0	958,609	958,609	958,609	958,609	958,609	958,609	958,609	958,609	958,609	958,609	958,609	958,609	958,609	
Up-Front Maintenance Reserve	68,618	0	0	0	0	0	0	0	0	0	0	0	0	0	
Working Capital	889,991	0	0	0	0	0	0	0	0	0	0	0	0	0	
Debt Service Reserve	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total	958,609	958,609	958,609	958,609	958,609	958,609	958,609	958,609	958,609	958,609	958,609	958,609	958,609	958,609	
Major 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	392,219	392,219	0	
Funding	39,222	39,222	39,222	39,222	39,222	39,222	39,222	39,222	39,222	39,222	39,222	39,222	39,222	0	
Release of Funds	0	0	0	0	0	0	0	0	0	0	0	0	(431,441)	0	
Ending Balance	39,222	78,444	117,666	156,888	196,110	235,332	274,553	313,775	352,997	39					

13	14	15	16	17	18	19	20
14,764	14,764	14,764	14,764	14,764	14,764	14,764	14,764
320.00	320.00	320.00	320.00	320.00	320.00	320.00	320.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
320.00	320.00	320.00	320.00	320.00	320.00	320.00	320.00
4,724,513	4,724,513	4,724,513	4,724,513	4,724,513	4,724,513	4,724,513	4,724,513
0	0	0	0	0	0	0	0
18,405	18,405	18,405	18,405	18,405	18,405	18,405	18,405
4,742,919	4,742,919	4,742,919	4,742,919	4,742,919	4,742,919	4,742,919	4,742,919
(1,340,566)	(1,366,305)	(1,392,538)	(1,419,275)	(1,446,525)	(1,474,298)	(1,502,605)	(1,531,455)
(778,908)	(793,863)	(809,105)	(824,640)	(840,473)	(856,610)	(873,057)	(889,820)
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
(86,597)	(88,259)	(89,954)	(91,681)	(93,441)	(95,235)	(97,064)	(98,928)
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
(3,080)	(3,045)	(3,010)	(2,975)	(2,940)	(2,905)	(2,870)	(2,835)
(2,209,151)	(2,251,473)	(2,294,608)	(2,338,572)	(2,383,380)	(2,429,049)	(2,475,596)	(2,523,038)
2,533,767	2,491,446	2,448,311	2,404,347	2,359,539	2,313,869	2,267,322	2,219,881
2,533,767	2,491,446	2,448,311	2,404,347	2,359,539	2,313,869	2,267,322	2,219,881
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	958,609
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	421
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
2,533,767	2,491,446	2,448,311	2,404,347	2,359,539	2,313,869	2,267,322	3,178,911
2,533,767	2,491,446	2,448,311	2,404,347	2,359,539	2,313,869	2,267,322	3,178,911
2,533,767	2,491,446	2,448,311	2,404,347	2,359,539	2,313,869	2,267,322	2,219,881
0	0	0	0	0	0	0	0
(56,328)	(28,164)	(14,082)	(7,041)	(3,521)	(1,760)	(880)	(440)
2,477,439	2,463,282	2,434,229	2,397,306	2,356,018	2,312,109	2,266,442	2,219,441
(18,000)	(18,000)	(18,000)	(18,000)	(18,000)	(18,000)	(18,000)	(18,000)
(332,390)	(330,125)	(325,477)	(319,569)	(312,963)	(305,937)	(298,631)	(291,111)
(371,616)	(369,492)	(365,134)	(359,596)	(353,403)	(346,816)	(339,966)	(332,916)
(722,006)	(717,617)	(708,611)	(697,165)	(684,366)	(670,754)	(656,597)	(642,027)
1,811,761	1,773,828	1,739,700	1,707,182	1,675,173	1,643,115	1,610,725	2,536,885
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
2,533,767	2,491,446	2,448,311	0	0	0	0	0
0	0	0	0	0	0	0	0
2,533,767	2,491,446	2,448,311	0	0	0	0	0
0	0	0	0	0	0	0	0
#DIV/0!	#DIV/0!	#DIV/0!					
958,609	958,609	958,609	958,609	958,609	958,609	958,609	958,609
0	0	0	0	0	0	0	(68,618)
0	0	0	0	0	0	0	(889,991)
0	0	0	0	0	0	0	0
958,609	958,609	958,609	958,609	958,609	958,609	958,609	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
18,405	18,405	18,405	18,405	18,405	18,405	18,405	18,405
100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
88.0%	87.0%	86.0%	85.0%	84.0%	83.0%	82.0%	81.0%
88,000	87,000	86,000	85,000	84,000	83,000	82,000	81,000
3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%
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											
Calendar Year		2010	2011	2012	2013	2014											
Tax Depreciation																	
Calendar Year Depreciation per Classification (%)																	
30% Double Declining			30.00%	21.00%	14.70%	10.29%											
50% Double Declining			50.00%	25.00%	12.50%	6.25%											
20-yr SL			2.50%	5.00%	5.00%	5.00%											
40-yr SL			1.25%	2.50%	2.50%	2.50%											
Other			0.00%	0.00%	0.00%	0.00%											
Calendar Year Depreciation per Classification (\$)																	
Year One Capital Cost Allocation		3,274,028	3,274,028	0	0	0											
30% Double Declining		0	0	0	0	0											
50% Double Declining		9,822,083	0	4,911,042	2,455,521	1,227,760											
20-yr SL		0	0	0	0	0											
40-yr SL		0	0	0	0	0											
Other		0	0	0	0	0											
Major Maintenance			0	0	0	0											
Annual Depreciation		13,527,112	3,274,028	4,911,042	2,455,521	1,227,760											
Major Maintenance																	
Timing of Spending																	
Occurrence 1			0	0	0	0											
Occurrence 2			0	0	0	0											
Occurrence 3			0	0	0	0											
Occurrence 4			0	0	0	0											
Depreciation Classification		50% Double Declining															
Year			0	1	2	3	4										
Depreciation Schedule			0.00%	50.00%	25.00%	12.50%	6.25%										
Depreciation Expense																	
		<table><tr><th>Expense</th><th>Depreciation Amount</th></tr><tr><td>Occurrence 1</td><td>431,441</td></tr><tr><td>Occurrence 2</td><td>0</td></tr><tr><td>Occurrence 3</td><td>0</td></tr><tr><td>Occurrence 4</td><td>0</td></tr></table>	Expense	Depreciation Amount	Occurrence 1	431,441	Occurrence 2	0	Occurrence 3	0	Occurrence 4	0					
Expense	Depreciation Amount																
Occurrence 1	431,441																
Occurrence 2	0																
Occurrence 3	0																
Occurrence 4	0																
Occurrence 1			0	0	0	0											
Occurrence 2			0	0	0	0											
Occurrence 3			0	0	0	0											
Occurrence 4			0	0	0	0											
Book Depreciation																	
Calendar Year Depreciation per Classification (%)																	
20-yr SL			5.00%	5.00%	5.00%	5.00%											
30-yr SL			3.33%	3.33%	3.33%	3.33%											
37-yr SL			2.70%	2.70%	2.70%	2.70%											
40-yr SL			2.50%	2.50%	2.50%	2.50%											
Calendar Year Depreciation per Classification (\$)																	
20-yr SL		16,608,105	830,405	830,405	830,405	830,405											
30-yr SL		0	0	0	0	0											
37-yr SL		0	0	0	0	0											
40-yr SL		0	0	0	0	0											
Major Maintenance			0	0	0	0											
Annual Depreciation		17,039,125	830,405	830,405	830,405	830,405											
Major Maintenance																	
Timing of Spending																	
Occurrence 1			0	0	0	0											
Occurrence 2			0	0	0	0											
Occurrence 3			0	0	0	0											
Occurrence 4			0	0	0	0											
Depreciation Classification		30-yr SL															
Year			0	1	2	3	4										
Depreciation Schedule			0.00%	3.33%	3.33%	3.33%	3.33%										
Depreciation Expense																	
		<table><tr><th>Expense</th><th>Depreciation Amount</th></tr><tr><td>Occurrence 1</td><td>431,441</td></tr><tr><td>Occurrence 2</td><td>0</td></tr><tr><td>Occurrence 3</td><td>0</td></tr><tr><td>Occurrence 4</td><td>0</td></tr></table>	Expense	Depreciation Amount	Occurrence 1	431,441	Occurrence 2	0	Occurrence 3	0	Occurrence 4	0					
Expense	Depreciation Amount																
Occurrence 1	431,441																
Occurrence 2	0																
Occurrence 3	0																
Occurrence 4	0																
Occurrence 1			0	0	0	0											
Occurrence 2			0	0	0	0											
Occurrence 3			0	0	0	0											
Occurrence 4			0	0	0	0											
Net Book Value																	
Beginning Balance			0	15,777,700	14,947,295	14,116,890											
Original Book Value			16,608,105	0	0	0											
Plus: Major Maintenance			0	0	0	0											
Less: Depreciation			(830,405)	(830,405)	(830,405)	(830,405)											
Net Book Value			15,777,700	14,947,295	14,116,890	13,286,484											

5	6	7	8	9	10	11	12	13	14	15
2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
7.20%	5.04%	3.53%	2.47%	1.73%	1.21%	0.85%	0.59%	0.42%	0.29%	0.20%
3.13%	1.56%	0.78%	0.39%	0.20%	0.10%	0.05%	0.02%	0.01%	0.01%	0.00%
5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
613,880	306,940	153,470	76,735	38,368	19,184	9,592	4,796	2,398	1,199	599
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	215,721	107,860	53,930	26,965	13,483
613,880	306,940	153,470	76,735	38,368	19,184	225,312	112,656	56,328	28,164	14,082

0	0	0	0	0	0	1	2	3	4	5
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0

5	6	7	8	9	10	11	12	13	14	15
3.13%	1.56%	0.78%	0.39%	0.20%	0.10%	0.05%	0.02%	0.01%	0.01%	0.00%

0	0	0	0	0	0	215,721	107,860	53,930	26,965	13,483
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0

5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%
2.70%	2.70%	2.70%	2.70%	2.70%	2.70%	2.70%	2.70%	2.70%	2.70%	2.70%
2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%	2.50%
830,405	830,405	830,405	830,405	830,405	830,405	830,405	830,405	830,405	830,405	830,405
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	215,721	107,860	53,930	26,965	13,483
830,405	830,405	830,405	830,405	830,405	830,405	1,046,126	938,266	884,335	857,370	843,888

0	0	0	0	0	0	1	2	3	4	5
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0

5	6	7	8	9	10	11	12	13	14	15
3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%	3.33%

0	0	0	0	0	0	215,721	107,860	53,930	26,965	13,483
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0

13,286,484	12,456,079	11,625,674	10,795,269	9,964,863	9,134,458	8,304,053	7,689,368	6,751,102	5,866,767	5,009,397
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	431,441	0	0	0	0
(830,405)	(830,405)	(830,405)	(830,405)	(830,405)	(830,405)	(1,046,126)	(938,266)	(884,335)	(857,370)	(843,888)
12,456,079	11,625,674	10,795,269	9,964,863	9,134,458	8,304,053	7,689,368	6,751,102	5,866,767	5,009,397	4,165,509

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 (\$)	\$0		\$0	\$0
Turbine installed cost (\$)	\$0		\$0	\$0
Emission controls	\$0		\$0	\$0
Condenser/Cooling Tower	\$0		\$0	\$0
Equipment and Installation (\$)	\$4,730,036	\$2,365,018	\$16,150,398	\$13,785,380
Interconnection (\$)	\$0		\$199,000	\$199,000
Maintenance reserve (\$)	\$65,279	\$32,639	\$101,258	\$68,618
Working capital reserve (\$)	\$440,913		\$1,152,979	\$889,991
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	\$2,295	\$1,148	\$5,718	\$4,570
Raw Water	\$9,642	\$4,821	\$32,495	\$27,674
Sewer	\$2,892	\$1,446	\$1,096	\$0
Water Treatment	\$2,169	\$1,084	\$90,398	\$89,314
Labour (\$)	\$40,768	\$20,384	\$218,904	\$198,520
Parasitic Power	\$153,827	\$76,914	\$239,573	\$162,660
General & Admin.	\$0		\$0	\$0
Insurance	\$23,650	\$11,825	\$80,752	\$68,927
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 (\$)	\$5,741,595		\$19,380,930	\$16,608,105
Total Project Costs (\$/kW)			\$8,029	\$6,880

Actual Loan Value: \$3,444,957

Actual Equity Amount: \$2,296,638

\$0

\$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 (\$)	\$0		\$0	
Turbine installed cost (\$)	\$0		\$0	
Emission controls	\$0		\$0	
Condenser/Cooling Tower	\$0		\$0	
Equipment and Installation (\$)	\$4,640,930	\$2,320,465	\$15,846,152	\$13,525,687
Interconnection (\$)	\$0		\$199,000	\$199,000
Maintenance reserve (\$)	\$64,049	\$32,024	\$99,350	\$67,326
Working capital reserve (\$)	\$432,607		\$1,131,259	\$873,225
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	\$2,252	\$1,126	\$5,610	\$4,484
Raw Water	\$9,460	\$4,730	\$31,883	\$27,153
Sewer	\$2,838	\$1,419	\$1,076	\$0
Water Treatment	\$2,128	\$1,064	\$88,695	\$87,631
Labour (\$)	\$40,000	\$20,000	\$214,780	\$194,780
Parasitic Power	\$150,929	\$75,465	\$235,060	\$159,596
General & Admin.	\$0	\$0	\$0	\$0
Insurance	\$23,205	\$11,602	\$79,231	\$67,628
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	\$13,525,687

Actual Loan Value:	\$3,380,060
Actual Equity Amount:	\$2,253,373

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

Boiler Parasitic Power Requirement	
Parasitic Power Requirement (MW)	0.217
Parasitic Power Requirement (MWh/yr)	1710.828
Cost of Parasitic Power Boiler Only (\$/yr)	\$150,929

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

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
\$0	\$0	\$1,718,000
\$0	\$0	\$85,000
\$0	\$0	\$130,041
\$0	\$0	\$758,000
\$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

\$0
\$12,809,510
\$640,475
\$13,449,985

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%

\$707,894
\$274,489
\$1,254,989
\$2,237,372
\$15,687,357

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

\$0	\$0	\$199,000
\$0	\$0	\$15,886,357