

# **Appendix I**

## **Preliminary Operational Cost Estimates**

Operational Cost Estimates  
Option 1, 2, 3, 4

Baseline Energy Information

Market cost of electricity	\$	0.05	\$/kW-hr
Market cost of natural gas	\$	4.00	\$/Therm
Steam requirements		83000	lb/hr
Electricity requirements		8000	kW

Annual Baseline Costs

Baseline Linpac Electricity Cost	\$	3,492,000
Baseline Linpac Gas Cost	\$	3,760,000
<b>Baseline Linpac Util Cost</b>	<b>\$</b>	<b>7,252,000</b>

OPTION 1

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Linpac Paper Biogas/Cogen Power Operating Cost Summary

Option 1: Existing boiler with biogas/natural gas fuel mix

	At 160,000 tpy	\$ Per Ton	Comments
<b>Corporate Administration Costs</b>			
Plant Manager		\$ -	
Secretary/Administrator		\$ -	
Corporate Resources		\$ -	
<b>TOTAL ADMINISTRATION</b>	<b>\$ 120,000</b>	<b>\$ 0.75</b>	
<b>Plant Wages</b>			
Biogas Plant	\$ 700,000	\$ 4.38	
Cogeneration Plant	\$ 20,000	\$ 0.13	
<b>TOTAL PLANT WAGES</b>	<b>\$ 720,000</b>	<b>\$ 4.50</b>	
<b>Maintenance</b>			
Biogas system maintenance	\$ 400,000	\$ 2.50	
Cogeneration system maintenance	\$ 20,000	\$ 0.13	
Buildings	\$ 15,000	\$ 0.09	
<b>TOTAL MAINTENANCE</b>	<b>\$ 435,000</b>	<b>\$ 2.72</b>	
<b>Mobile Equipment</b>			
Loader Machine	\$ 2,000	\$ 0.01	
Bobcat	\$ 1,000	\$ 0.01	
Plant Truck	\$ 1,000	\$ 0.01	
<b>TOTAL MOBLE EQUIP.</b>	<b>\$ 4,000</b>	<b>\$ 0.03</b>	
<b>Chemicals</b>			
Hardness Stabilizer for digester	\$ 90,000	\$ 0.56	
Defoamer	\$ 65,000	\$ 0.41	
Biofilter	\$ 5,000	\$ 0.03	
Flocculant for screw presses	\$ 200,000	\$ 1.25	
<b>TOTAL CHEMICALS</b>	<b>\$ 360,000</b>	<b>\$ 2.25</b>	
<b>Utilities- Biogas Plant</b>			
Water	\$ 20,000	\$ 0.13	
Wastewater	\$ 20,000	\$ 0.13	
Solid Waste	\$ 50,000	\$ 0.31	
Natural Gas	\$ 10,000	\$ 0.06	use biogas product
Electricity	\$ 436,000	\$ 2.73	\$0.05/kW-hr from market
<b>TOTAL BIOGAS PLANT UTILITIES</b>	<b>\$ 536,000</b>	<b>\$ 3.35</b>	
<b>Other</b>			
Office & Supplies	\$ 100,000	\$ 0.63	
Insurance	\$ 75,000	\$ 0.47	
Property Taxes	\$ 30,000	\$ 0.19	
Government Reporting	\$ 15,000	\$ 0.09	
Capital Tax	\$ 100,000	\$ 0.63	

OPTION 1

Debt Principal	\$ -	\$ -	in capital budget
Debt Interest	\$ -	\$ -	in capital budget
BTA Plant Operating Fee	\$ -	\$ -	in capital budget
Operating Contingency	\$ 100,000	\$ 0.63	
Operating Profit Margin	\$ -	\$ -	
<b>TOTAL OTHER</b>	<b>\$ 420,000</b>	<b>\$ 2.63</b>	

<b>TOTAL PLANT OPERATING EXPENSES</b>	<b>\$ 2,595,000</b>	<b>\$ 16.22</b>
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Cogeneration Costs		
Electricity - from market	\$ 3,742,000	
Natural Gas - from market	\$ 2,560,000	
Cogen Operator	\$ -	
Cogen Maintenance	\$ -	
Cogen other	\$ -	
<b>TOTAL LINPAC GAS &amp; ELECTRIC</b>	<b>\$ 6,302,000</b>	

<b>TOTAL PLANT + GAS/ELECTRIC</b>	<b>\$ 8,897,000</b>
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Assumptions:

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Fuel value of biogas 300000 therms

Electricity from biogas/cogen: 0 kW

Total cogen gas requirement 940000 therms

Capital Cost of Biogas/Cogen	\$ 24,700,000
Annual Total Savings	\$ (1,645,000)
Annual Cogen Savings	\$ 950,000

Option 2

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Linpac Paper Biogas/Cogen Power Operating Cost Summary

Option 2: Steam Turbine Cogeneration with Boiler Backup

	At 160,000 tpy	\$ Per Ton	Comments
<b>Corporate Administration Costs</b>			
Plant Manager		\$ -	
Secretary/Administrator		\$ -	
Corporate Resources		\$ -	
<b>TOTAL ADMINISTRATION</b>	<b>\$ 120,000</b>	<b>\$ 0.75</b>	
<b>Plant Wages</b>			
Biogas Plant	\$ 700,000	\$ 4.38	
Cogeneration Plant	\$ 20,000	\$ 0.13	
<b>TOTAL PLANT WAGES</b>	<b>\$ 720,000</b>	<b>\$ 4.50</b>	
<b>Maintenance</b>			
Biogas system maintenance	\$ 400,000	\$ 2.50	
Cogeneration system maintenance	\$ 20,000	\$ 0.13	
Buildings	\$ 15,000	\$ 0.09	
<b>TOTAL MAINTENANCE</b>	<b>\$ 435,000</b>	<b>\$ 2.72</b>	
<b>Mobile Equipment</b>			
Loader Machine	\$ 2,000	\$ 0.01	
Bobcat	\$ 1,000	\$ 0.01	
Plant Truck	\$ 1,000	\$ 0.01	
<b>TOTAL MOBLE EQUIP.</b>	<b>\$ 4,000</b>	<b>\$ 0.03</b>	
<b>Chemicals</b>			
Hardness Stabilizer for digester	\$ 90,000	\$ 0.56	
Defoamer	\$ 65,000	\$ 0.41	
Biofilter	\$ 5,000	\$ 0.03	
Flocculant for screw presses	\$ 200,000	\$ 1.25	
<b>TOTAL CHEMICALS</b>	<b>\$ 360,000</b>	<b>\$ 2.25</b>	
<b>Utilities- Biogas Plant</b>			
Water	\$ 20,000	\$ 0.13	
Wastewater	\$ 20,000	\$ 0.13	
Solid Waste	\$ 50,000	\$ 0.31	
Natural Gas	\$ 10,000	\$ 0.06	use biogas product
Electricity	\$ 200,000	\$ 1.25	
<b>TOTAL BIOGAS PLANT UTILITIES</b>	<b>\$ 300,000</b>	<b>\$ 1.88</b>	
<b>Other</b>			
Office & Supplies	\$ 100,000	\$ 0.63	
Insurance	\$ 75,000	\$ 0.47	
Property Taxes	\$ 30,000	\$ 0.19	
Government Reporting	\$ 15,000	\$ 0.09	
Capital Tax	\$ 100,000	\$ 0.63	

Option 2

Debt Principal	\$	-	\$	-	in capital budget
Debt Interest	\$	-	\$	-	in capital budget
BTA Plant Operating Fee	\$	-	\$	-	in capital budget
Operating Contingency	\$	100,000	\$	0.63	
Operating Profit Margin	\$	-	\$	-	
<b>TOTAL OTHER</b>	<b>\$</b>	<b>420,000</b>	<b>\$</b>	<b>2.63</b>	

<b>TOTAL PLANT OPERATING EXPENSES</b>	<b>\$</b>	<b>2,359,000</b>	<b>\$</b>	<b>14.74</b>
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Linpac Gas & Electric				
Electricity - from market	\$	3,562,162		
Natural Gas - from market	\$	3,200,000		
<b>Cogen Operator</b>	\$	60,000		
Cogen Maintenance	\$	20,000		
Cogen other	\$	-		
<b>TOTAL LINPAC GAS &amp; ELECTRIC</b>	<b>\$</b>	<b>6,842,162</b>		

<b>TOTAL PLANT + GAS/ELECTRIC</b>	<b>\$</b>	<b>9,201,162</b>
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Assumptions:

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Fuel value of biogas 300000 therms

Electricity from biogas/cogen: 412 kW

Total cogen gas requirement 1.10E+06 therms

Capital Cost of Biogas/Cogen	\$	28,000,000
Annual Total Savings	\$	(1,949,162)
Annual Cogen Savings	\$	409,838

Option 3

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Linpac Paper Biogas/Cogen Power Operating Cost Summary

Option 3: Reciprocating Engine Cogeneration with Boiler backup

	At 160,000 tpy	\$ Per Ton	Comments
<b>Corporate Administration Costs</b>			
Plant Manager		\$ -	
Secretary/Administrator		\$ -	
Corporate Resources		\$ -	
<b>TOTAL ADMINISTRATION</b>	<b>\$ 120,000</b>	<b>\$ 0.75</b>	
<b>Plant Wages</b>			
Biogas Plant	\$ 700,000	\$ 4.38	
Cogeneration Plant	\$ 20,000	\$ 0.13	
<b>TOTAL PLANT WAGES</b>	<b>\$ 720,000</b>	<b>\$ 4.50</b>	
<b>Maintenance</b>			
Biogas system maintenance	\$ 400,000	\$ 2.50	
Cogeneration system maintenance	\$ 20,000	\$ 0.13	
Buildings	\$ 15,000	\$ 0.09	
<b>TOTAL MAINTENANCE</b>	<b>\$ 435,000</b>	<b>\$ 2.72</b>	
<b>Mobile Equipment</b>			
Loader Machine	\$ 2,000	\$ 0.01	
Bobcat	\$ 1,000	\$ 0.01	
Plant Truck	\$ 1,000	\$ 0.01	
<b>TOTAL MOBLE EQUIP.</b>	<b>\$ 4,000</b>	<b>\$ 0.03</b>	
<b>Chemicals</b>			
Hardness Stabilizer for digester	\$ 90,000	\$ 0.56	
Defoamer	\$ 65,000	\$ 0.41	
Biofilter	\$ 5,000	\$ 0.03	
Flocculant for screw presses	\$ 200,000	\$ 1.25	
<b>TOTAL CHEMICALS</b>	<b>\$ 360,000</b>	<b>\$ 2.25</b>	
<b>Utilities- Biogas Plant</b>			
Water	\$ 20,000	\$ 0.13	
Wastewater	\$ 20,000	\$ 0.13	
Solid Waste	\$ 50,000	\$ 0.31	
Natural Gas	\$ 10,000	\$ 0.06	use biogas product
Electricity	\$ 200,000	\$ 1.25	
<b>TOTAL BIOGAS PLANT UTILITIES</b>	<b>\$ 300,000</b>	<b>\$ 1.88</b>	
<b>Other</b>			
Office & Supplies	\$ 100,000	\$ 0.63	
Insurance	\$ 75,000	\$ 0.47	
Property Taxes	\$ 30,000	\$ 0.19	
Government Reporting	\$ 15,000	\$ 0.09	
Capital Tax	\$ 100,000	\$ 0.63	

Option 3

Debt Principal	\$	-	\$	-	in capital budget
Debt Interest	\$	-	\$	-	in capital budget
BTA Plant Operating Fee	\$	-	\$	-	in capital budget
Operating Contingency	\$	100,000	\$	0.63	
Operating Profit Margin	\$	-	\$	-	
<b>TOTAL OTHER</b>	<b>\$</b>	<b>420,000</b>	<b>\$</b>	<b>2.63</b>	

<b>TOTAL PLANT OPERATING EXPENSES</b>	<b>\$</b>	<b>2,359,000</b>	<b>\$</b>	<b>14.74</b>
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Linpac Gas & Electric				
Electricity - from market	\$	1,472,200		
Natural Gas - from market	\$	3,760,000		
<b>Cogen Operator</b>	\$	60,000		
Cogen Maintenance	\$	20,000		
Cogen other	\$	-		
<b>TOTAL LINPAC GAS &amp; ELECTRIC</b>	<b>\$</b>	<b>5,312,200</b>		

<b>TOTAL PLANT + GAS/ELECTRIC</b>	<b>\$</b>	<b>7,671,200</b>		
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Assumptions:

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Fuel value of biogas 300000 therms

Electricity from biogas/cogen: 5200 kW

Total cogen gas requirement 1240000 therms

Capital Cost of Biogas/Cogen	\$	30,200,000
Annual Total Savings	\$	(419,200)
Annual Cogen Savings	\$	1,939,800

Option 4

**CONFIDENTIAL PROJECT**

Linpac Paper Biogas/Cogen Power Operating Cost Summary

Option 4: Gas Turbine Cogeneration with boiler backup

	At 160,000 tpy	\$ Per Ton	Comments
<b>Corporate Administration Costs</b>			
Plant Manager		\$ -	
Secretary/Administrator		\$ -	
Corporate Resources		\$ -	
<b>TOTAL ADMINISTRATION</b>	<b>\$ 120,000</b>	<b>\$ 0.75</b>	
<b>Plant Wages</b>			
Biogas Plant	\$ 700,000	\$ 4.38	
Cogeneration Plant	\$ 20,000	\$ 0.13	
<b>TOTAL PLANT WAGES</b>	<b>\$ 720,000</b>	<b>\$ 4.50</b>	
<b>Maintenance</b>			
Biogas system maintenance	\$ 400,000	\$ 2.50	
Cogeneration system maintenance	\$ 20,000	\$ 0.13	
Buildings	\$ 15,000	\$ 0.09	
<b>TOTAL MAINTENANCE</b>	<b>\$ 435,000</b>	<b>\$ 2.72</b>	
<b>Mobile Equipment</b>			
Loader Machine	\$ 2,000	\$ 0.01	
Bobcat	\$ 1,000	\$ 0.01	
Plant Truck	\$ 1,000	\$ 0.01	
<b>TOTAL MOBLE EQUIP.</b>	<b>\$ 4,000</b>	<b>\$ 0.03</b>	
<b>Chemicals</b>			
Hardness Stabilizer for digester	\$ 90,000	\$ 0.56	
Defoamer	\$ 65,000	\$ 0.41	
Biofilter	\$ 5,000	\$ 0.03	
Flocculant for screw presses	\$ 200,000	\$ 1.25	
<b>TOTAL CHEMICALS</b>	<b>\$ 360,000</b>	<b>\$ 2.25</b>	
<b>Utilities- Biogas Plant</b>			
Water	\$ 20,000	\$ 0.13	
Wastewater	\$ 20,000	\$ 0.13	
Solid Waste	\$ 50,000	\$ 0.31	
Natural Gas	\$ 10,000	\$ 0.06	use biogas product
Electricity	\$ 200,000	\$ 1.25	
<b>TOTAL BIOGAS PLANT UTILITIES</b>	<b>\$ 300,000</b>	<b>\$ 1.88</b>	
<b>Other</b>			
Office & Supplies	\$ 100,000	\$ 0.63	
Insurance	\$ 75,000	\$ 0.47	
Property Taxes	\$ 30,000	\$ 0.19	
Government Reporting	\$ 15,000	\$ 0.09	
Capital Tax	\$ 100,000	\$ 0.63	

