COST AND BENEFIT ANALYSIS FOR THE ELDER PROCESS

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BACKGROUND

The Elder Process is a patented technology that involves the uniform heating and cooling of green lumber in a controlled environment for various periods of time. The purpose of the Elder Process is to prevent enzymatic stain and fungal stains from developing in hardwood lumber. Prior to the Elder Process, there was no effective method for preventing enzymatic stains (Simpson, 1991). The presence of stains in hardwood lumber decreases lumber quality. The annual value lost due to the presence of the enzymatic stains to the major hardwood lumber species in the U.S. was estimated to be over 200 million dollars (Schmidt and Amburgey, 1997).

At the request of the City of Jasper and the Jasper Economic Development Corporation, the Texas Forest Service conducted a cost and benefit analysis of the Elder Process based on existing information about the technology. The sources of data used in this analysis about the Elder Process are found in Table 1. The Texas Forest Service also consulted wood drying specialists and researched wood drying literature and hardwood market reports to verify data given to the extend possible. The Texas Forest Service did not conduct separate scientific experiments on the Elder Process. The results of this analysis may be used by individuals and companies which are interested in this technology to make their own assessments of the process.

COST ANALYSIS

Major Assumptions

It was assumed that a new Elder Processor would be built with a life expectancy of 15 years. The processor would include a boiler providing steam and heat, a processing chamber that would hold lumber, a T-shed for lumber storage and air drying, plus rails and carts that help feed lumber into the chamber. Although the chamber structure and boilers may last more than 15 years, technological progress and increasing maintenance cost as the facility ages would make a longer projected life too costly. In addition to these factors, the patent of the Elder Process is scheduled to expire in 15 years.

In this analysis, the Elder Processor was assumed to be located either with a sawmill or with a conventional dry kiln operation. If located with a sawmill, the processor may be owned by either the sawmill or by a dry kiln operation that has an agreement with the sawmill.

Southern red oak lumber was used exclusively for this cost and benefit analysis. Red oak is the most important hardwood species in the South and is subject to the enzymatic stain problem in the drying process. The cost and benefit for Elder-processing may be different for other species.

Processor Configurations

Three scenarios of processor configurations were analyzed. The first scenario is a 25 thousand board feet (mbf) Elder processor on a sawmill site; the second scenario is a 50-mbf Elder Processor on a sawmill site; and the third scenario is a 50-mbf Elder Processor on a dry kiln site with six 50-mbf conventional dry kilns. It takes approximately 36 hours per cycle to treat red oak in the Elder Processor. Taking into account the time for loading and unloading, it would be reasonable to assume that there could be 4 processing cycles in one week. Therefore there could be 208 cycles (4*52 weeks) in one year. This is considered to be the full capacity of the processor. We also consider the possibility of 3 processing cycles per week in this analysis, which is 75% of the full capacity. The processor configurations have cost implications.

In the first and second scenarios, the graded and stickered lumber would be treated in an Elder processor and then shipped with sticks to a dry kiln operation for air and kiln drying. In the third scenario, graded lumber would be transported to the dry kiln site immediately after it is sawn. Graded lumber would be stickered and treated in an Elder processor at the site. The lumber would be air-dried and kiln-dried at the same location.

Cost Amortization and Interest Estimation

The interest rate for the capital investment and operating costs was assumed to be a 10% fixed rate over the life of the project. Although current interest rate is lower than 10%, there is reason to believe the interest rate will increase in the future. Ten percent is a reasonable average rate over the long term to reflect the cost of financing and the opportunity cost of the project. All costs and benefits estimated here are in 2002 dollars.

The principle and interest for the capital investment were amortized over the 15-year project life, assuming the total capital investment will be paid with fifteen equal annual payments. It was assumed that there would be no significant residual value left after the end of the project. The turnover time for the operating costs was assumed to be one month. The annual interest for the operating costs was based on one-twelveth of the total annual operating costs.

Capital Investment

The capital investment for an Elder Processor includes the costs for a boiler for producing steam and heat, a chamber for housing the lumber, a slab for the chamber, rails and carts for loading and unloading lumber, and a T-shed for sheltering lumber before and after processing, and the labor cost for installation of all the components. These costs differ by the size of the processor (Table 2)[1].

In the first and second scenarios, the processor is powered by a gas-fired low-pressure steam boiler sized appropriately for the processor chamber. In the third scenario, the processor and six dry kilns would share one waste-fired boiler that would cost $456,214 per unit. The cost share of the boiler for the Elder processor would be 20.3% based on its share of the total energy consumption from the boiler. Costs for land and forklifts would also be parts of capital investment. It would take half an acre to build a 25-mbf Elder

[1] All the costs for building an Elder Processor were quoted from Mr. Don J. Engel, Arti International, Inc.

Processor and a half forklift (shared with a sawmill) for the same capacity facility. The land requirement would not change much for a 50-mbf processor but the use of the forklift would be doubled for the higher capacity processor. The cost of land was assumed to be $3000 per acre and the cost of the forklift was assumed to be $45,000 per unit.

Operating Costs

The operating costs of an Elder Processor would include maintenance and energy costs for a boiler, a chamber and a forklift, and personnel and administrative costs for operating and managing the facility.

It would cost about $300 in chemicals and labor every quarter for the maintenance of a 25-mbf boiler. It would cost an average of $50 each month for the maintenance of a 25-mbf-chamber, which mainly involves replacing fans and fixing electronic components. The maintenance for a 50-mbf boiler and chamber would cost twice as much. The Elder Processor's share of the maintenance cost for the waste-fired boiler would be $253.19 per quarter, based on approximately 20.3% of the total $1250 per quarter total maintenance cost of the boiler. It would cost about $1000 each year for maintaining each forklift.

There would be three types of energy costs: natural gas for the boiler, electricity for fans in the chamber and diesel fuel for the forklift. The estimation of the cost for natural gas is in Appendix A. It would cost $95.94 per cycle for a 25-mbf gas-fired boiler and $166.69 per cycle for a 50-mbf gas-fired boiler. There would be no natural gas cost for the waste-fired boiler. The waste-fired boiler would use wood waste generated from planing the kiln-dried lumber.

The cost for electricity per cycle was based on the following formula:

Electricity cost = number of fans * kilowatts per fan * total hours per cycle * cost of electricity per kilowatt hour

The estimated costs for electricity consumption by the fans in the processor are presented in Table 3.

A forklift would be needed to load and unload the lumber in and out of the Elder Processor. Only the cost for loading was considered because that is an added step in the regular milling process. It was assumed that it takes one hour to load a 25-mbf processor and 2 hours to load a 50-mbf processor. The diesel fuel consumption per hour per forklift was assumed to be 3.5 gallons and the cost of diesel per gallon was assumed to be $1.00. So it would cost $3.50 for diesel fuel to load a 20-mbf processor and $7.00 for diesel fuel to load a 50-mbf processor.

Personnel and administrative costs include the cost of an operator/manager of the Elder Processor, the cost of a forklift operator and the administrative costs. The task of an operator/manager of the processor is to schedule the production of the Elder Processor, operate the processor and monitor it for any potential problems the processor might have. Managers of existing Elder Processor operations say it takes very little time to accomplish that. It was assumed that the work could be done by an operator/manager already employed by the sawmill or dry kiln, and the processor's portion of the person's annual salary of $40,000 would be 10%, regardless of the size of the processor. It was assumed that it would cost $10.00 per hour for the forklift operator's time.

The administrative cost was based on the assumption that the cost of a general manager with an annual salary and benefits of $75,000, an administrative assistant with an annual salary and benefits of $30,000, and office expenses of $10,000 would need to be shared by the Elder Processor and a sawmill or a dry kiln, depending on the location of the Elder Processor. It was assumed that a 25-mbf processor would share one-quarter of the total $115,000 annual administrative cost and a 50-mbf processor would share one-half of the administrative cost.

The costs for grading and stickering lumber were not included in this analysis. Although it is necessary to grade and sticker lumber before the Elder-processing, these procedures are necessary for conventional drying as well. It was assumed that the costs for grading and stickering lumber before the Elder Process would be fully recovered and these costs would not affect the cost and benefit analysis of the Elder Process.

Licensing Fee

Since the Elder Process is a patented technology, there is a licensing fee for using it. The current annual licensing fee is $1.00 for each board foot of processor capacity. For example, the annual total licensing fee for a 25-mbf Elder processor is $25,000, regardless of how often the processor gets used.

Summary of Cost Analysis

The results of the cost analysis for the three scenarios of processor configurations are presented in Tables 4-6. Table 4 gives the results of the cost analysis for a 25-mbf Elder Processor at a sawmill site running at its full annual capacity. It would take $252,946 for all capital investments, including the costs for a 25-mbf Elder Processor, half an acre of land and 50% of the cost for a forklift. The annual cost for the capital investment over the 15-year life of the project would be $33,255.77. The total annual operating costs would be $73,845.28. The interest on the operating costs would be $615.38 each year. The annual licensing fee would be $25,000. The total annual cost would be $132,716.42. The total cost per mbf would be $25.52, which would include the $20.71/mbf processing cost and the $4.81/mbf licensing fee.

Table 5 gives the results of the cost analysis for a 50-mbf Elder Processor at a sawmill site running at its full annual capacity. In this scenario, it would cost $364,278 for initial investment, about 44% more than the first scenario. The total annual cost for the processor would be $228,858.04, 72.4% more than the first scenario. It included $47,893 for the payments on the initial investment, $129,882.68 for the operating costs, $1,082.36 for the interest on the operating cost and $50,000 for the licensing fee. The unit cost would be $22.01/mbf, including the $17.20/mbf processing cost and the $4.81/mbf licensing fee. The unit processing cost in this scenario would be 13.3% less than the first scenario but the unit licensing fee per mbf was the same in both cases.

The results of the cost analysis for a 50-mbf Elder processor at a dry kiln site running at its full annual capacity are summarized in Table 6. The initial investment cost in this scenario would be $416,206.98, 16.1% higher than the same size processor at a sawmill site, due to the higher cost of the waste-fired boiler than the gas-fired boiler. On the other hand, due to the energy cost saved by using wood waste, the total operating cost in this case would be only $93,824,44 per year, 27.8% less than using gas-fired boiler. The total annual cost in this scenario would be $199,326.61. The total unit cost would be $19.17/mbf, including the $14.36/mbf processing cost and $4.81/mbf licensing fee. The total unit cost would be 12.9% less than the second scenario and 24.9% less than the first scenario.

If the processors were running at less than their full capacity, the total unit cost per mbf would increase, because the initial capital investment and the annual licensing cost would be the same regardless of whether the capacity of the processor is fully utilized. Tables 7-9 summarize the costs of operating the processor in the three scenarios at 75% of its full annual capacity. For the first scenario, at a 75% capacity utilization rate, the unit total cost would be $29.64/mbf, 16.2% higher than when the processor capacity was fully utilized. In this case, the unit processing cost would increase 12.2% and the unit licensing fee would increase 33.3%. For the second scenario, the unit total cost would be $25.73/mbf when the processor capacity was at 75%, a 16.9% increase over the full utilization of the processor. In this case, the unit processing cost and the unit licensing fee would be 12.3% and 33.3% over full utilization, respectively. For the third scenario, the unit total cost would increase 24.7% to $23.91 if only 75% of the total processor capacity is used. Unit processing cost would increase 21.9% and the unit licensing fee would increase 33.3%.

BENEFIT ANALYSIS

From on-site interviews and discussions with wood drying specialists, it is believed that, if done properly, the Elder Process can prevent stains, including enzymatic stains, from developing in hardwood lumber. There are both environmental as well as economic benefits for implementing the Elder Process.

Environmental Benefits

The Elder Process eliminates the need for chemical dipping that are usually used in an attempt to prevent green lumber from developing stains and insect infestations. Hardwood drying operations routinely use various fungicides in an attempt to control enzymatic stains as well as fungal stains in green lumber. Many lumber producers also use “brighteners” to improve the appearance of the lumber products and insecticides to prevent the infestation of Ambrosia beetles. The practitioners of the Elder Process have reportedly discontinued the use of all chemicals that were previously utilized in lumber production without experiencing problems because of enzymatic stains and insect infestation.

The Elder Process does not require the use of any chemicals to work. It does create some tannic enriched water as a byproduct of its process. During the process, tannins, which are a naturally occurring bio-degradable element in the heartwood of hardwood lumber, leech out of the heartwood and combines with the water condensate in the chamber to form a tannic fluid that can be released into the environment. The inventor created an evaporation tank as part of the processing unit that will evaporate the water part of the solution.

Economic Benefits

There are three economic benefits to implementing the Elder Process. The first economic benefit is due to the elimination of the chemical dipping process. The second economic benefit is the interest saved by reducing lumber air-drying time after Elder Processing. The third benefit is from the premium price expected to be paid for the Elder-processed lumber because of the improved lumber quality.

Saved Costs for Chemical Dipping

Without implementing the Elder Process, a lumber-drying mill would usually dip the green lumber into fungicides, brighteners, and insecticides in an attempt to protect the lumber from enzymatic stains, fungal stains and insect infestation. The average cost of chemicals used for dipping would cost about $8.50/mbf. The machinery and labor costs for chemical dipping varies depending on the level of automation of the chemical dipping process. For small operations, a forklift is used to dip lumber into the solutions in a chemical tank placed in a containment enclosure. For middle to large operations, chemical dipping is usually integrated with stickering and highly automated, which costs more in equipment and less in labor.

Interest Savings

The Elder Process has reportedly shortened the air-drying time and thus reduced the time that lumber must be kept in inventory before it can be utilized. Without using the Elder Process, it usually takes 90-120 days of air-drying time for 4/4″ thick hardwood lumber to reduce the moisture content to about 30% where it will be ready for kiln-drying. The exact time needed for air-drying depends on the starting moisture content of the green lumber and weather conditions (temperature, humidity and wind). The processed wood reportedly loses 10% to 15% of its moisture content in the first 24 hours after Elder-processing and then air-dries at an accelerated rate without significant drying defects. The exact mechanism for the accelerated air-drying after the Elder-processing is not clear.

There were no known scientific experiments conducted on the average air-drying time the Elder Process would save. Anecdotal evidence suggests it can save anywhere from 15% to 50% of the air-drying time. Lacking accurate data on average air-drying time that can be saved, a 30-day average was used to illustrate the potential benefit that can be derived from implementing the Elder Process. The formula for calculating the interest saved per mbf from the reduced air-drying time is:

Average price of green lumber per mbf * daily interest rate * number of days

The formula for calculating the annual total savings per processor is:

Processor Size (mbf) * total number of cycles per year * interest saved per mbf

Assuming that the average price for green southern red oak lumber is $550/mbf and the interest rate is 10%, the average interest saved by reducing air-drying time for average green southern red oak lumber per mbf can be calculated as $550*(10%/365)*30 = $4.52.

The annual total savings for a 25 mbf processor at its full capacity would be 25 * 208 * $4.52 = $23,506.85 and the annual total savings for a 50-mbf processor at its full capacity would be twice as much.

Price Premium from Lumber Quality Improvement

The Elder Process improves lumber quality by preventing enzymatic stain from developing in the sapwood. In addition, the Elder Process also reduces the color differential between the heartwood and sapwood, especially in red oak lumber. The process apparently causes some diffusion of colored extractives from the heartwood into the sapwood, similar to the process used with black walnut lumber. Because of the improvement, vendors that implemented the Elder Process reported that they routinely received a $50-$100/mbf price premium for the processed and kiln-dried lumber for FAS and # 1 Common grade lumber. The price premium is higher for better lumber grades. There was not as great a price premium for processed green lumber. However, the processed green lumber reportedly enjoyed better market access. In slow markets when sawmills had difficulty selling green lumber, vendors reported that it was easier to sell Elder-Processed green lumber.

The second source of improvement is from the reduction of drying defect and degrade. According to the Dry Kiln Operator's Manual (Simpson, 1991) published by the U.S. Forest Service, "a drying defect is any characteristic or blemish in a wood product that occurs during the drying process and reduces the product's intended value. Drying degrade is a more specific term that implies a drying defect that lowers the grade of lumber." The percentage of drying defects in hardwood lumber varies by species, seasons and many other factors. With the Elder Process, a substantial reduction of the drying defect has been witnessed.

The third source of improvement is from the ability to make thicker red oak lumber such as 6/4″ and 8/4″ that previously could not be made in the south. Because of the acceleration of air-drying and reduction of drying defects, it is technically feasible and economically profitable to produce thicker lumber. The practitioners of the Elder Process have reportedly successfully dried 6/4″ and 8/4″ southern red oak in only a little more time than it previously took to dry 4/4″ lumber with no enzymatic stain and few, if any drying defects.

SUMMARY

No cost and benefit analysis is complete without a set of summary statistics such as net present value, rate of return and payback period. The major difficulty, in this analysis, to generate such a set of numbers is the uncertainty of the total economic benefit of the project. The uncertainty comes from several sources. First, the price premium for the Elder-processed lumber may differ by the combination of lumber grades processed and by the market that the processed lumber is sold to. Second, given the length of the project, the price premium could change over time with the expanded implementation of the technology. Third, since the knowledge of, and utilization of, the Elder Process is in its early stages, there is just not enough information to accurately estimate the total benefit of the technology. In this analysis, we used $50.00/mbf as the total benefit of the

Elder Process, the lower-end of the currently reported price premium for processed dry lumber and disregarded the benefits from cost savings, grade improvement and the ability to produce thicker lumber. The results are summarized in Table 10.

In general, the Elder Process fared very well comparing the cost and benefit of implementing the technology, even without taking into account the benefits other than the price premiums. The Elder Process is also environmental friendly. This analysis is only a case study and may not apply to every situation. Readers need to do their own cost and benefit analysis before implementing the Elder Process.

REFERENCES

Schmidt, Elmer L. and Terry L. Amburgey. 1997. Prevention of Non-Microbial Enzymatic Sapstain by Log Fumigation. Prevention of Discolorations in Hardwood and Softwood Logs and Lumber, Forest Products Society, Madison, WI.

Simpson, William T. 1991. Dry Kiln Operator's Manual. USDA Forest Service, Forest Products Laboratory, Madison, WI. Agriculture Handbook 188. Revised August 1991. P191.

APPENDIX A: BTU CONSUMPTION FOR THE ELDER PROCESSOR

Provided courtesy of Mr. Don Lewis, P.E. & President of NYLE Dry Kilns in Bangor, Maine

The formula for calculating the BTU needed to warm lumber in an Elder Processor is:

(BF * ODW * HS * (T2 – T1)) + BF * ODW * (MC * (T2 – T1))

Where: BF = Total Board feet

ODW = Oven dry weight in pounds.

HS = Specific Heat – the amount of heat (BTU) required to heat the product 1°F. It is about 0.35 for most wood.

T1 = Initial Temperature °F.

T2 = Final temperature in °F

MC = Moisture content of wood as a decimal:
MC = 1- (wet weight – dry weight)/dry weight

Add 100,000 BTU per hour for heat loss due to transmission and leakage from the chamber.

An example: calculating the total BTU needed for processing red oak in a 25-mbf Elder Processor. The MC of the wood is 70% and is to be heated in 3 hours from 50^0F to 160^0F and then held for 33 more hours.

BTU for warming lumber =

(25,000 * 3.5 * 0.35 * (160 – 50)) + 25,000 * 3.5 * (0.70 * (160 – 50)) = 10,106,250

Total BTU = 10,106,250 + 36 * 100,000 = 13,706,250

It would take 13.7 million BTU for each cycle in a 25-mbf processor. Assuming $7.00/million BTU for natural gas cost, it would cost $166.69 per cycle for a 25-mbf Elder Processor.

Table 1. Data Sources

Name	Company	Location	Phone	Note
Danny Elder	Elder Hardwoods	Kirbyville, TX	(409) 423-5177	Inventor of the Elder Process
Don J. Engel	Arti International, Inc.	Sarepta, LA	(800) 474-4440	Dry kiln vendor
Lex Shaw	Hill County Hardwoods, Inc.	Round Rock, TX	(512) 246-0160	Lumber wholesaler that purchased Elder-processed lumber
Don Lewis	NYLE Dry Kilns	Bangor, Maine	(800) 777-6953	Dry Kiln manufacturer
Lou Maher	Precision Hardwoods	Mt. Enterprise	(903) 822-3251	Sawmill that has a 20-mbf Elder Processor

Table 2. Costs for Building an Elder Processor

Processor Size (MBF)	Horse Power	Boiler		Processor Chamber	Slab, rail, carts and labor	T-shed	Total
		Gas-fired	Waste-fired				
20	40	$25,034		$93,000	$31,500	$64,000	$213,534
25	45	$26,396		$103,000	$34,300	$66,000	$229,696
30	50	$27,758		$115,000	$37,100	$68,000	$247,858
40	70	$37,539		$132,000	$42,700	$72,000	$284,239
50	90	$41,228		$153,000	$48,300	$76,000	$318,528
50	300		$92,407	$153,000	$48,300	$76,000	$369,707

Note: although the full cost analysis was not done for processor sizes 20, 30 and 40, the cost quotes for the processors are presented here for reference. All data in this table are from Don J. Engel, Arti International Inc.

Table 3. Electricity Cost for Fans

Processor Size (MBF)	Number of Fans	Cost/cycle
20	6	$61.78
25	7	$72.07
30	7	$72.07
40	8	$82.37
50	10	$102.96

Note: Kilowatts per fan = 2.2; Total hours per cycle = 36;
Cost of electricity per kilowatt hour = $0.13;
All data in this table are from Don J. Engel, Arti International Inc. Some practitioners of the Elder Process have reportedly used less number of fans and thus incurred substantially less electricity cost without compromising the processing quality.

Table 4. Cost Estimates for a 25 MBF Elder Processor (Full apacity Utilized) at a Sawmill Site

Life of the Project (Year):	15
Interest Rate:	10%
Processor Capacity (mbf):	25
Processing Cycles Per Year:	208
Total Annual Capacity (mbf):	5200
Capacity Utilization Rate:	100%
Licensing Fee ($/bf/yr capacity)	$1.00

Item	Unit Cost	Units		Annual Cost
Elder Processor (25-mbf)	$229,696.00	1	unit	$30,199.00
Land cost	$1,500.00	0.5	acre	$98.61
Forklift	$45,000.00	0.5	unit	$2,958.16
Total capital investment	$252,946.00			$33,255.77
Boiler Maintenance	$300.00	4	quarters	$1,200.00
Chamber Maintenance	$50.00	12	months	$600.00
Forklift Maintenance	$500.00	1	year	$500.00
Natural Gas for Boiler	$95.94	208	cycles	$19,956.30
Electricity for Fans	$72.07	208	cycles	$14,990.98
Diesel Fuel for Forklift	$3.50	208	cycles	$728.00
Operator/Manager	$40,000.00	0.1	person	$4,000.00
Forklift Operators	$15.00	208	cycles	$3,120.00
Administrative cost	$115,000.00	25	percent	$28,750.00
Total Operating Costs				$73,845.28
Interest				$615.38
Annual Licensing Fee				$25,000.00
Total Annual Costs				$132,716.42
Unit Processing Cost ($/mbf)				**$20.71**
Unit Licensing Fee ($/mbf)				**$4.81**
Unit Total Cost ($/mbf)				**$25.52**

Table 5. Cost Estimates for a 50 MBF Elder Processor (Full Capacity Utilized) at a Sawmill Site

Life of the Project (Year):	15
Interest Rate:	10%
Processor Capacity (mbf):	50
Processing Cycles Per Year:	208
Total Annual Capacity (mbf):	10400
Capacity Utilization Rate:	100%
Licensing Fee ($/bf/yr capacity)	$1.00

Item	Unit Cost	Units		Annual Cost
Elder Processor (50-mbf)	$318,528.00	1	unit	$41,878.08
Land cost	$1,500.00	0.5	acre	$98.61
Forklift	$45,000.00	1	unit	$5,916.32
Total capital investment	$364,278.00			$47,893.00
Boiler Maintenance	$600.00	4	quarters	$2,400.00
Chamber Maintenance	$100.00	12	months	$1,200.00
Forklift Maintenance	$1,000.00	1	year	$1,000.00
Natural Gas for Boiler	$166.69	208	cycles	$34,671.00
Electricity for Fans	$102.96	208	cycles	$21,415.68
Diesel Fuel for Forklift	$7.00	208	cycles	$1,456.00
Operator/Manager	$40,000.00	0.1	person	$4,000.00
Forklift Operators	$30.00	208	cycles	$6,240.00
Administrative cost	$115,000.00	50	percent	$57,500.00
Total Operating Costs				$129,882.68
Interest				$1,082.36
Annual Licensing Fee				$50,000.00
Total Annual Costs				$228,858.04
Unit Processing Cost ($/mbf)				**$17.20**
Unit Licensing Fee ($/mbf)				**$4.81**
Unit Total Cost ($/mbf)				**$22.01**

Table 6. Cost Estimates for a 50 MBF Elder Processor (Full Capacity Utilized) at a Dry Kiln Site

Life of the Project (Year):	15
Interest Rate:	10%
Processor Capacity (mbf):	50
Processing Cycles Per Year:	208
Total Annual Capacity (mbf):	10400
Capacity Utilization Rate:	100%
Licensing Fee ($/bf/yr capacity)	$1.00

Item	Unit Cost	Units		Annual Cost
Elder Processor (50-mbf)	$369,706.98	1	unit	$48,606.77
Land cost	$3,000.00	0.5	acre	$197.21
Forklift	$45,000.00	1	unit	$5,916.32
Total capital investment	$416,206.98			$54,720.30
Boiler Maintenance[1]	$253.19	4	quarters	$1,012.76
Chamber Maintenance	$100.00	12	months	$1,200.00
Forklift Maintenance	$1,000.00	1	year	$1,000.00
Electricity for Fans	$102.96	208	cycles	$21,415.68
Diesel Fuel for Forklift	$7.00	208	cycles	$1,456.00
Kiln & Processor Operator	$40,000.00	0.1	person	$4,000.00
Forklift Operators	$30.00	208	cycles	$6,240.00
Administrative cost	$115,000.00	50	percent	$57,500.00
Total Operating Costs				$93,824.44
Interest				$781.87
Annual Licensing Fee				$50,000.00
Total Annual Costs				$199,326.61
Unit Processing Cost ($/mbf)				**$14.36**
Unit Licensing Fee ($/mbf)				**$4.81**
Unit Total Cost ($/mbf)				**$19.17**

Note: the total maintenance cost for the waste-fired boiler was quoted as $1250 per quarter.
The Elder Processor's share of the cost was based on 20.3% of the total BTU consumption of the boiler.

Table 7. Cost Estimates for a 25 MBF Elder Processor (75% Full apacity Utilized) at a Sawmill Site

Life of the Project (Year):	15
Interest Rate:	10%
Processor Capacity (mbf):	25
Processing Cycles Per Year:	208
Total Annual Capacity (mbf):	5200
Capacity Utilization Rate:	75%
Licensing Fee ($/bf/yr capacity)	$1.00

Item	Unit Cost	Units		Annual Cost
Elder Processor (25-mbf)	$229,696.00	1	unit	$30,199.00
Land cost	$1,500.00	0.5	acre	$98.61
Forklift	$45,000.00	0.5	unit	$2,958.16
Total capital investment	$252,946.00			$33,255.77
Boiler Maintenance	$300.00	4	quarters	$1,200.00
Chamber Maintenance	$50.00	12	months	$600.00
Forklift Maintenance	$500.00	1	year	$500.00
Natural Gas for Boiler	$95.94	156	cycles	$11,225.42
Electricity for Fans	$72.07	156	cycles	$8,432.42
Diesel Fuel for Forklift	$3.50	156	cycles	$409.50
Operator/Manager	$40,000.00	0.1	person	$4,000.00
Forklift Operators	$15.00	156	cycles	$1,755.00
Administrative cost	$115,000.00	25	percent	$28,750.00
Total Operating Costs				$56,872.34
Interest				$473.94
Annual Licensing Fee				$25,000.00
Total Annual Costs				$115,602.04
Unit Processing Cost ($/mbf)				**$23.23**
Unit Licensing Fee ($/mbf)				**$6.41**
Unit Total Cost ($/mbf)				**$29.64**

Table 8. Cost Estimates for a 50 MBF Elder Processor (75% Full Capacity Utilized) at a Sawmill Site

Life of the Project (Year):	15
Interest Rate:	10%
Processor Capacity (mbf):	50
Processing Cycles Per Year:	208
Total Annual Capacity (mbf):	10400
Capacity Utilization Rate:	75%
Licensing Fee ($/bf/yr capacity)	$1.00

Item	Unit Cost	Units		Annual Cost
Elder Processor (50-mbf)	$318,528.00	1	unit	$41,878.08
Land cost	$1,500.00	0.5	acre	$98.61
Forklift	$45,000.00	1	unit	$5,916.32
Total capital investment	$364,278.00			$47,893.00
Boiler Maintenance	$600.00	4	quarters	$2,400.00
Chamber Maintenance	$100.00	12	months	$1,200.00
Forklift Maintenance	$1,000.00	1	year	$1,000.00
Natural Gas for Boiler	$166.69	156	cycles	$19,502.44
Electricity for Fans	$102.96	156	cycles	$12,046.32
Diesel Fuel for Forklift	$7.00	156	cycles	$819.00
Operator/Manager	$40,000.00	0.1	person	$4,000.00
Forklift Operators	$30.00	156	cycles	$3,510.00
Administrative cost	$115,000.00	50	percent	$57,500.00
Total Operating Costs				$101,977.76
Interest				$849.81
Annual Licensing Fee				$50,000.00
Total Annual Costs				$200,720.58
Unit Processing Cost ($/mbf)				**$19.32**
Unit Licensing Fee ($/mbf)				**$6.41**
Unit Total Cost ($/mbf)				**$25.73**

Table 9. Cost Estimates for a 50 MBF Elder Processor (75% Full Capacity Utilized) at a Dry Kiln Site

Life of the Project (Year):	15
Interest Rate:	10%
Processor Capacity (mbf):	50
Processing Cycles Per Year:	208
Total Annual Capacity (mbf):	10400
Capacity Utilization Rate:	75%
Licensing Fee ($/bf/yr capacity)	$1.00

Item	Unit Cost	Units		Annual Cost
Elder Processor (50-mbf)	$369,706.98	1	unit	$48,606.77
Land cost	$3,000.00	0.5	acre	$197.21
Forklift	$45,000.00	1	unit	$5,916.32
Total capital investment	$416,206.98			$54,720.30
Boiler Maintenance[1]	$253.19	4	quarters	$1,012.76
Chamber Maintenance	$100.00	12	months	$1,200.00
Forklift Maintenance	$1,000.00	1	year	$1,000.00
Electricity for Fans	$102.96	156	cycles	$12,046.32
Diesel Fuel for Forklift	$7.00	156	cycles	$819.00
Kiln & Processor Operator	$40,000.00	0.1	person	$4,000.00
Forklift Operators	$30.00	156	cycles	$3,510.00
Administrative cost	$115,000.00	50	percent	$57,500.00
Total Operating Costs				$81,088.08
Interest				$675.73
Annual Licensing Fee				$50,000.00
Total Annual Costs				$186,484.12
Unit Processing Cost ($/mbf)				**$17.50**
Unit Licensing Fee ($/mbf)				**$6.41**
Unit Total Cost ($/mbf)				**$23.91**

Note: the total maintenance cost for the waste-fired boiler was quoted as $1250 per quarter.
The Elder Processor's share of the cost was based on 20.3% of the total BTU consumption of the boiler.

Table 10. Summary of Cost and Benefit for the Elder Process

Processor Size (MBF)	Processor Location	Capacity Utilization Rate	Annual Cost	Annual Revenue	Annual Profit	Net Present Value (NPV)	Rate of Return	Payback Period (year)
25	Sawmill	100%	$132,716	$260,000	$127,284	$968,129	66.2%	2.0
25	Sawmill	75%	$115,602	$195,000	$79,398	$603,907	43.7%	3.2
50	Sawmill	100%	$228,858	$520,000	$291,142	$2,214,449	90.7%	1.3
50	Sawmill	75%	$186,484	$390,000	$203,516	$1,439,674	63.8%	1.9
50	Dry Kiln	100%	$199,327	$520,000	$320,673	$2,439,067	88.7%	1.3
50	Dry Kiln	75%	$200,721	$390,000	$189,279	$1,547,958	61.2%	2.0

Note: price premium was assumed to be $50/mbf for Elder-processed lumber.