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Northeastern Area
State and Private Forestry

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Preliminary Feasibility Report

Biomass Heating Analysis for FiberMark

Lowville, New York

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EXECUTIVE SUMMARY

FiberMark is a small paper plant located in the village of Lowville, New York. The facility has approximately 200,000 square feet of conditioned space in one building and uses two hot water boilers for both process heat and building heat. The existing hot water boilers were recently converted to natural gas and all heat is currently provided by natural gas.

The facility currently uses approximately 68,000 Dekatherms (Dth) of natural gas each year. However, the facility only used an average of 27,896 Dth in their boilers. The rest is used for process heat and packaged rooftop units that would be difficult to retrofit for hot water produced from the boilers. The average price paid by the facility over the past two years was $9.08 per Dth. At that price FiberMark will spend more than $250,000 on natural gas this coming year for heat produced from the facility's boilers.

FiberMark does not appear to be a strong candidate for a woodchip heating system. While the site is well-suited for a stand-alone woodchip boiler house and chip storage, the potential fuel savings are not large enough to offset the capital investment for this facility. The analysis provided in this report indicates that FiberMark could save nearly $80,000 in fuel costs in the first year, but that the financing costs would be considerably greater than the fuel savings.

Unless grant funding or tax incentives can be used to substantially decrease the capital costs of a biomass project, Yellow Wood does not recommend moving forward with a biomass heat project at this time. The *Additional Issues to Consider* section of this report does outline potential opportunities for making a biomass system more attractive, including converting the direct-fired dryer to a steam coil and investigating the opportunities associated with a Combined Heat and Power project. There are also likely energy efficiency opportunities that FiberMark could investigate that could offer very good rates of return. To investigate these energy efficiency opportunities Yellow Wood recommends that NYSERDA should be engaged to develop comprehensive energy efficiency recommendations and proposals for incentives for efficiency upgrades. Information on NYSERDA programs is included in the *Biomass and Green Building Resources* binder accompanying this report.

This preliminary feasibility study was prepared by Yellow Wood Associates in collaboration with Richmond Energy Associates, LLC for the FiberMark Paper Mill in Lowville, NY. Both Yellow Wood and Richmond Energy have extensive community economic development experience and Richmond Energy specializes in biomass energy projects. This study was funded by the Wood Education and Resource Center, Northeastern Area State and Private Forestry, U.S. Department of Agriculture.

INTRODUCTION

There is a significant volume of low-grade biomass in the United States that represents a valuable economic and environmental opportunity if it can be constructively used to produce energy. Commercially available biomass heating systems can provide heat cleanly and efficiently in many commercial applications. Biomass heating technologies are being used quite successfully in over 40 public schools in Vermont alone and the concept of heating institutions with wood is catching on in several other areas of the United States and Canada. Good candidate facilities for biomass energy systems include those that have high heating bills, those that have either steam or hot water heating distribution systems and those that have ready access to reasonably priced biomass fuel.

This report is a pre-feasibility assessment specifically tailored to FiberMark outlining whether or not woodchip heating makes sense for this facility from a practical perspective. In June 2010, staff from Yellow Wood Associates traveled to Lowville, NY to tour the facility. This assessment includes site specific fuel savings projections based on historic fuel consumption, and provides facility decision-makers suggestions and recommendations on next steps.

The study was funded by the U.S. Department of Agriculture Wood Education and Resource Center.

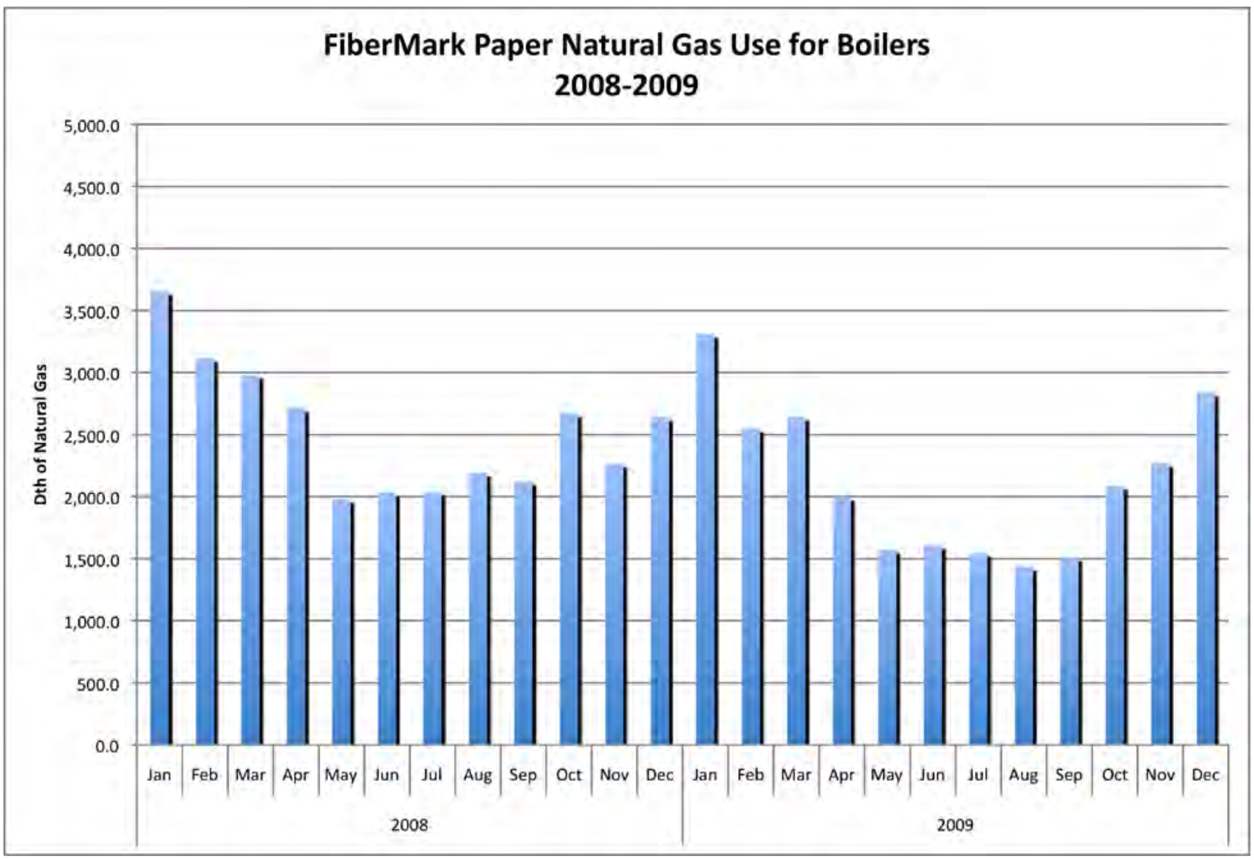
This preliminary feasibility study was prepared by Yellow Wood Associates and Richmond Energy Associates, LLC.

ANALYSIS ASSUMPTIONS

DESCRIPTION OF THE EXISTING HEATING SYSTEM

FiberMark manufactures specialty paper products in a single 200,000 square foot facility. The facility operates two hot water boilers (one 14.5 mBtu and one 10.5 mBtu) that were recently converted to natural gas. The smaller of the two boilers is over 50 years old and is only used occasionally to provide supplemental heat. The larger boiler provides space heating and process heat for papermaking. While the entire plant uses about 68,000 Dekatherms (Dth) of natural gas per year on average, only about a third of it goes to fuel the boilers. The rest is used in direct-fired driers and some rooftop package-heating units.

Table 1: Boiler Energy Use

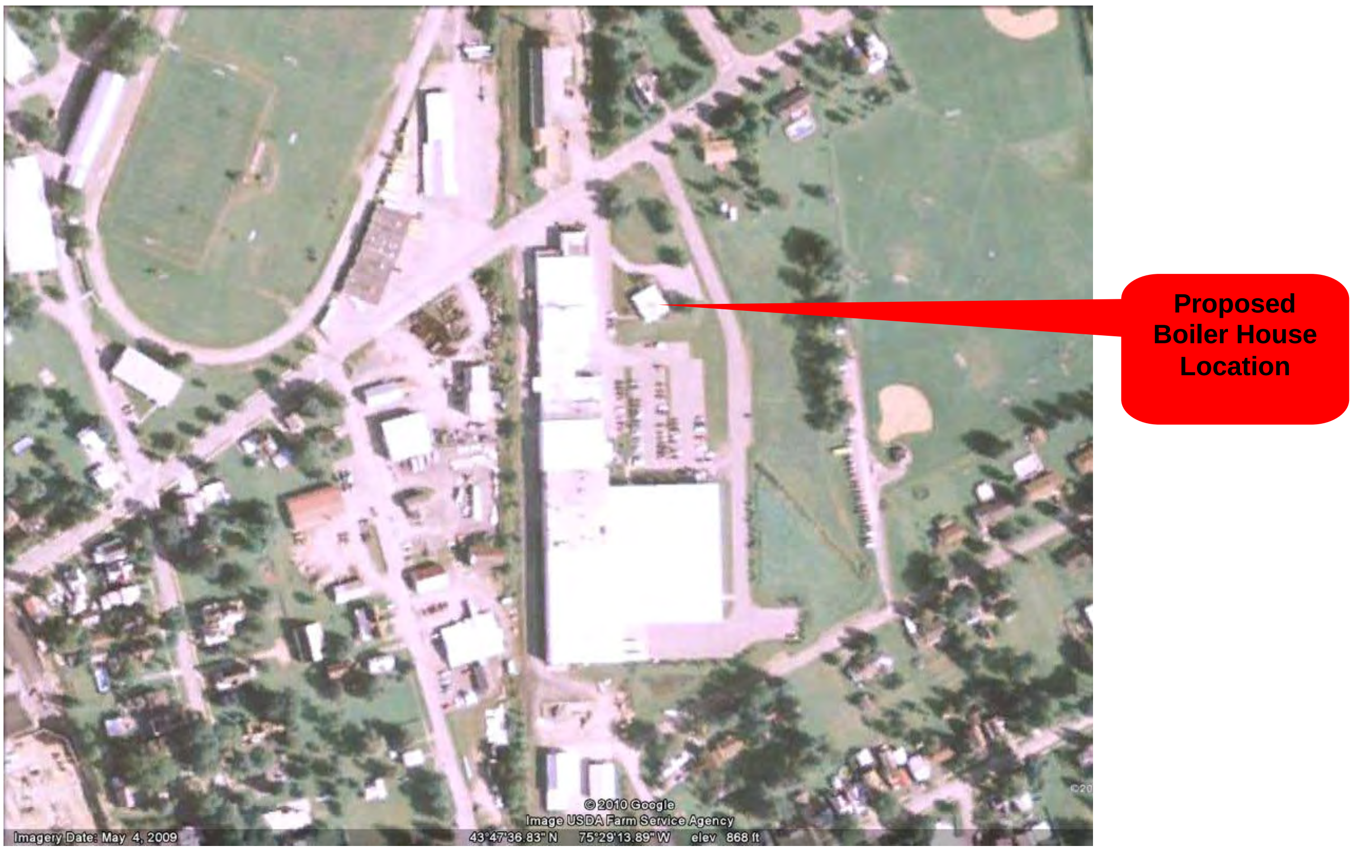


The two-year average annual natural gas consumption for both boilers was 27,896 Dth. This was the amount that was used in the analysis.

DESCRIPTION OF THE PROPOSED BIOMASS SYSTEM

The biomass scenario envisions re-using an existing building to create a biomass boilerhouse and adding 1,500 square foot chip storage bunker to that building. The new facility would house a 9.0 mmBtu woodchip hot water boiler, woodchip fuel storage and fuel handling equipment to feed the boiler automatically. A single biomass system would serve the entire facility. The scenario assumes the existing hot water boilers would remain to provide back-up heat for the shoulder seasons and supplemental heat during the coldest days of the year if necessary. Figure 1 shows the suggested boiler house location.

Figure 1: Proposed Biomass Boiler Location



Hot water from the woodchip boiler house would be tied into the existing boiler systems via approximately 175 feet of underground insulated piping. Costs for a tall stack were included to ensure good emissions dispersal. Costs for an underground woodchip storage bin were included, as below grade chip storage bins are less likely to freeze in the coldest winter weather and chip delivery using self unloading trailers into below grade bins is fast and easy. A healthy construction contingency, standard general contractor mark-up and professional design fees were also included. Figure 2 shows an example of a typical biomass boiler house and chip storage building.

Figure 2: Williamstown, VT High School Woodchip Boiler Plant

LIFE CYCLE COST METHODOLOGY

Decision makers need practical methods for evaluating the economic performance of alternative choices for any given purchasing decision. When making a choice between mutually exclusive capital investments, it is prudent to compare all equipment and operating costs spent over the life of the longest lived alternative in order to determine the true least cost choice. The total cost of acquisition, fuel costs, operation and maintenance of an item throughout its useful life is known as its "life cycle cost." Life cycle costs that should be considered in a life cycle cost analysis include:

- Capital costs for purchasing and installing equipment
- Fuel costs
- Inflation for fuels, operational labor and major repairs
- Annual operation and maintenance costs including scheduled major repairs
- Salvage costs of equipment and buildings at the end of the analysis period.

It is useful for decision makers to consider the impact of debt service if the project is to be financed in order to get a clearer picture of how a project might affect annual budgets. When viewed in this light, equipment with significant capital costs may still be the least-cost alternative. In some cases, a significant capital investment may actually lower annual expenses, if there are sufficient fuel savings to offset debt service and any incremental increases in operation and maintenance costs.

The analysis performed for this facility compares a biomass scenario to the existing natural gas fuel consumption over a 30-year horizon and takes into consideration life cycle cost factors. The biomass scenario is a heat only option that would cover 85% of the current annual heat load for the entire facility (including space and process heat). The biomass scenario includes all ancillary equipment and interconnection costs. Under the biomass scenario, the existing natural gas boilers would still be used to provide supplemental and back-up heat. A 30-year time frame is used for both scenarios because it is the expected life of a new boiler.

The analysis projects current and future annual natural gas bills and compares that cost against the cost of operating a biomass system. Savings are presented in today's dollars using a net present value calculation. Net present value (NPV) is defined as the present dollar value of net cash flows over time. This is a standard method for using the time value of money to compare the cost effectiveness of long-term projects.

It is not the intent of this project, nor was it in the scope of work, to develop detailed cost estimates for a biomass boiler facility. It is recommended that for a project of this scale, FiberMark would need to hire a qualified design team to refine the project concept and to develop firm local cost estimates. Therefore the capital costs used for the biomass scenario are generic estimates based on our experience with similar scale projects.

NATURAL GAS COST ASSUMPTIONS

Fuel bills provided by FiberMark indicate that this facility uses an average of 68,185 Dth of natural gas per year to heat the building being considered in this analysis. However, only about one-third of that gas usage is used in the existing boilers. The rest is used for direct fired driers and packaged rooftop heating units that would be difficult to retrofit. The average natural gas usage for the boilers alone over the past two years was 27,896 Dth. This is the assumed annual fuel consumption used for the base case in the analysis. Over the past two years, FiberMark paid an average of $9.08 per Dth of natural gas; the biomass scenario in this study uses this price for the first year of the analysis. At that price, FiberMark will spend more than $253,296 for natural gas for use in their boilers next year.

WOODCHIP FUEL COST ASSUMPTIONS

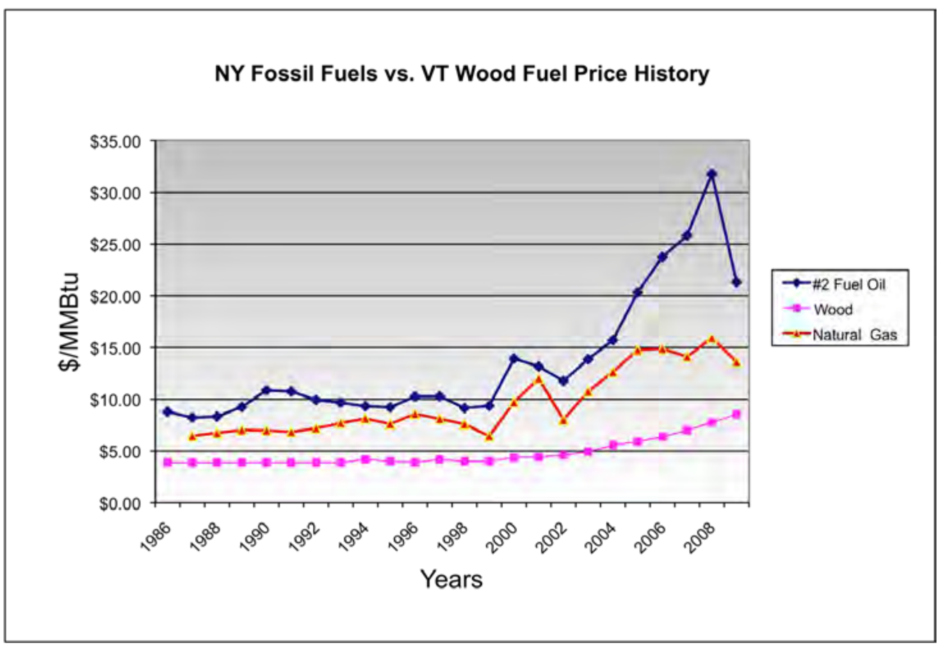
The biomass boiler characterized for this study is somewhat smaller than the existing boiler that carries the bulk of the heating load at this facility. Biomass boilers work most efficiently when they work harder. By sizing the biomass boiler at or below peak heating demand, it will run at higher capacity more of the time and therefore operate more efficiently. We are recommending that the facility keep its existing boiler capacity to provide back-up and supplemental heat if necessary. The woodchip scenario in this study assumes the facility will meet 85% of the year round boiler heating needs for the facility with woodchips and therefore consume 2,715 tons of chips per year. After consulting with other woodchip users in the region, we are projecting a first year cost of $50 per ton for woodchips which is equivalent to about $5.70 per Dth of natural gas. The remaining 15% of the heating needs were then assumed to be provided by the existing natural gas boilers consuming about 4,184 Dth of natural gas. The cost for supplemental natural gas is then adjusted for inflation each year over the 30-year horizon.

INFLATION ASSUMPTIONS

Estimating future fuel costs over time is difficult at best. Over the past few years it has become even more difficult as fuel prices have fluctuated dramatically. Nevertheless, in order to more accurately reflect future costs in a thirty-year analysis, some rate of inflation needs to be applied to future fuel costs.

We looked retrospectively over the last 20 years (1990 – 2009) using US Energy Information Agency data and found that the average annual increase for natural gas in New York was 5.6% per year. The analysis projects this average inflation rate for natural gas forward over the thirty-year analysis period. FiberMark's fuel rate of $9.08/Dth was used for the first year of the analysis and then inflated each year at 5.6%.

Figure 3: Woodchip and Fossil Fuel Inflation



The overall Consumer Price Index for the period between 1990 and 2009, the last year for which full data is available, increased an average of 2.6% annually. This is the annual inflation rate that was used in projecting all future labor costs, operations and maintenance costs and scheduled major repair costs for the biomass scenario.

The cost of woodchips used for heating fuel tends to increase more slowly and has historically been much more stable in price over the past two decades than fossil fuels. In Vermont for example, the statewide average woodchip fuel price for institutional biomass heating systems rose from $25/ton to $55/ton in the period between 1990 and 2009. The average annual increase during this period was about 3.6% annually[1] with the greatest increases happening recently. Because woodchip fuel is locally produced from what is generally considered a waste product from some other forest product business, it does not have the same geopolitical pressures that fossil fuels have. Over the past twenty years, woodchip fuel costs have been far less volatile than fossil fuels. For the analysis in this report the cost of woodchip fuel was inflated 3.6% annually for the thirty years of the analysis.

OPERATION AND MAINTENANCE ASSUMPTIONS

For this facility it was assumed that one half-time staff person would need to be hired to properly maintain the boiler and to supervise operation. At a loaded rate of $25/hr. it was assumed FiberMark would need to spend $25,000 in labor costs for the operations and maintenance of a biomass boiler.

It was also estimated that the biomass boiler and fuel handling equipment would consume an additional 320,000 kWh of electricity annually. At $.1382/kWh, the most recent price paid for electricity, it was estimated that FiberMark would spend another $44,000 in electricity to run the biomass boiler and ancillary equipment. Another $6,000 was added to annual maintenance cost to account for ash disposal.

Another operations and maintenance cost that is included in the analysis is periodic repair or replacement of major items on the boiler such as the furnace refractory. It is reasonable to anticipate these types of costs on a 10-15 year cycle. For this analysis, $25,000 of scheduled maintenance was anticipated in years 10, 20 and 30 and then annualized at $2,500 per year to simulate a sinking fund for major repairs. This $2,500 was then inflated at the general annual inflation rate.

Under any biomass scenario, a case could be made that the existing heating units will require less maintenance and may last longer since they will only be used for a small portion of the heating season. In FiberMark's case, perhaps the older boiler could be retired altogether. However, all heating equipment should be serviced at least annually no matter how much it is used. Additionally it is very difficult to estimate how long the replacement of the existing units might be delayed. For these reasons, no additional annual maintenance, scheduled repair or planned replacement costs for the existing natural gas boilers were taken into consideration as these are considered costs that FiberMark would have paid anyway. It was assumed that all costs for the operation and maintenance of a biomass boiler are incremental additional costs.

[1] Extrapolated from Vermont Superintendent Association School Energy Management Program data. Vermont wood chip price history is used because it is one of the only states that has this historical data.

FINANCING ASSUMPTIONS

This analysis assumes that FiberMark will finance the biomass project with a 7% loan. At this time the analysis does not take into account any potential tax credits, grants or low interest loans that may be available. See the section in this report on Project Funding Opportunities to learn about alternative funding and financing options. Other financing schedules could create more favorable cash flows depending on how much of the project costs are financed and how the remaining costs are financed. A sensitivity analysis based on alternative financing costs is included in the appendices. There is also a section in this report on Project Funding Opportunities that includes information on alternative funding and financing options.

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BIOMASS SCENARIO ANALYSIS

The analysis shows that FiberMark would actually lose money over a thirty year time horizon by installing a woodchip heating system. The facility would save nearly $80,000 in annual fuel costs in the first year. These savings would increase over time as natural gas prices continue to climb. But the debt service would more than offset fuel cost savings and the project would not even have a positive cash flow for many years.

Table 2: Woodchip Scenario Analysis Assumptions

FiberMark Paper Biomass Heat Only Scenario					
Capital Cost Assumptions					
10 mmBtu biomass steam boiler system including installation					$900,000
Stack and breeching					$35,000
300 cubic yard chip storage building and chip storage bunker	1,500	SF	$200	/SF	$300,000
Buried insulated piping to connect biomass boiler house with the existing boiler room	150	LF	$150	/LF	$22,500
Thermal storage 9,000 gallon					$90,000
Pollution control equipment					$600,000
Site preparation					$50,000
Interconnection to existing systems					$100,000
GC markup at 10%					$209,750
Construction contingency at 15%					$346,088
Design at 12%					$318,401
Total estimated project costs					$2,971,738
State or Federal Grants	**0%**				$0
Total Facility Share					$2,971,738
Financing Costs					
Financing, annual interest rate					7.0%
Finance term (years)					15
1st full year debt service					$356,609
Fuel Cost Assumptions					
Current annual natural gas use (Dth)					27,896
Assumed natural gas price in 1st year (Dth)					$9.08
Projected annual natural gas bill					$253,296
Assumed wood price in 1st year (per ton)					$50
Projected 1st year wood fuel bill					$135,732
Projected 1st year supplemental natural gas bill					$37,994
Inflation Assumptions					
General inflation rate (twenty year average CPI)					2.6%
Natural gas inflation rate (twenty year average EIA)					5.6%
Wood inflation rate (average increase in VT from 1990 - 2009 is 3.6%)					3.6%
O&M Assumptions					
Annual Wood O&M cost, including electricity for additional pumps and motors and staff time for daily and yearly maintenance					$75,000
Major repairs (annualized)					$2,500
Savings					
Net 1st year fuel savings					**$79,569**
Total 30 year NPV cumulative savings					**($1,690,682)**

Figure 4: Annual Cash Flow Graph for Woodchip Scenario

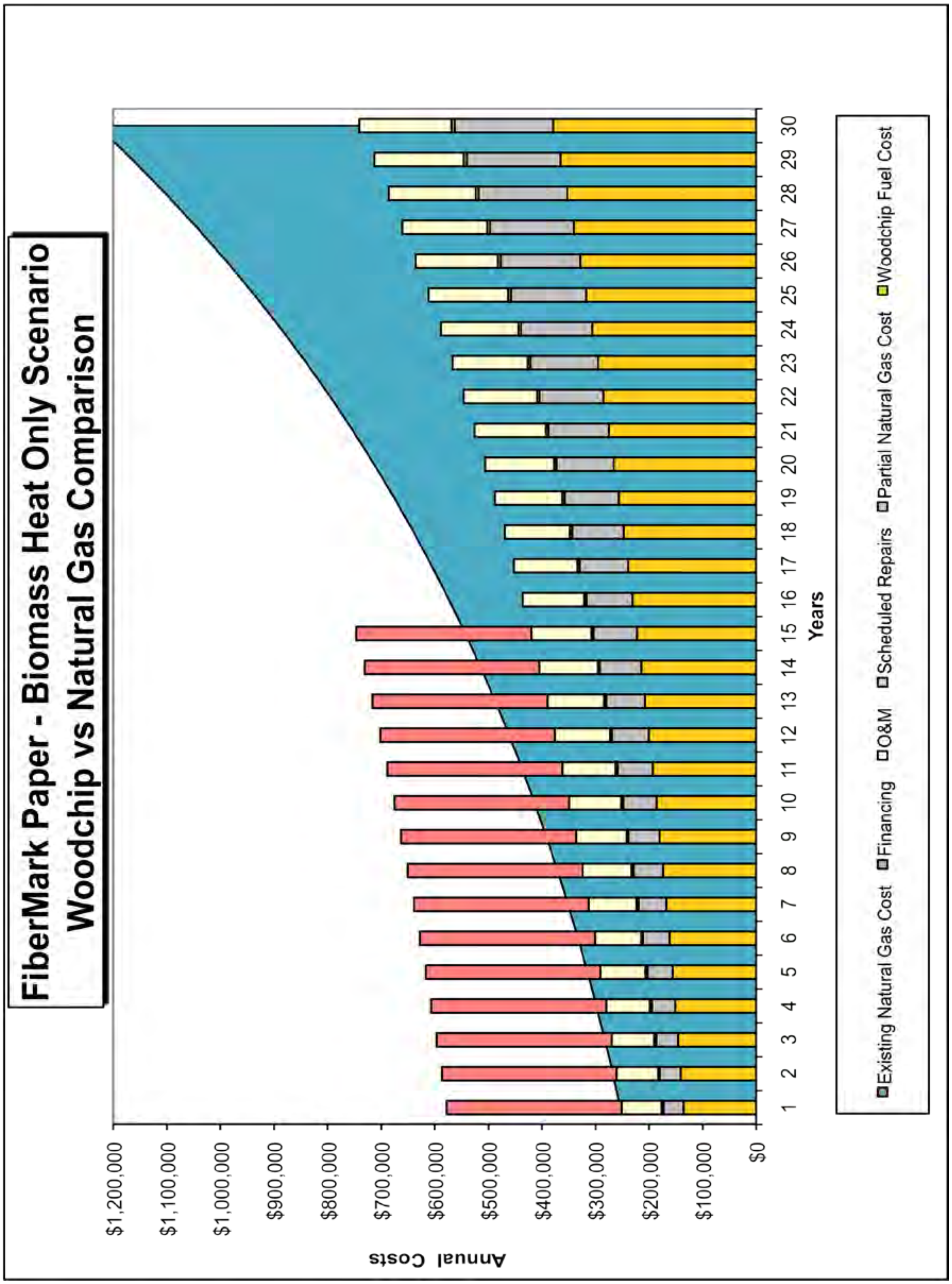


Table 3: 30-Year Life Cycle Analysis Spreadsheet for Woodchip Scenario

FiberMark Paper — **Preliminary Life Cycle Cost Estimate** — ***Wood Chip - Heat Only***

Total estimated construction costs	$2,971,738	*Estimated state or federal grants*	**$0**
Facilty Cost Share:	$2,971,738		
Financing:	7.0%	*Assumed interest rate each year, 15 years*	
Natural Gas heat consumption	27,896	DThs/year	15% Natural Gas = 4,184 DThs; 3,194 tons if 100% woodchips for Natural Gas; 9 DTh / ton of woodchips
Natural Gas heat price	$9.08	/DTh in year 1	
Natural Gas heat cost	$253,296		
Estimated woodchip utilization	85%		
Projected woodchip consumption	2,715	tons	
Estimated 1st year woodchip price	$50	/ ton Year 1	
Projected 1st year woodchip cost	$135,732		
General Inflation:	2.6%	annually	*Twenty year average annual US Labor Dept. Consumer Price Index increases*
Natural Gas Inflation	5.6%	annually	*Average Increase for New York Commercial NG users from 1991 - 2009 (US EIA)*
Woodchip Inflation:	3.6%	annually	*Average increase for woodchips for schools in Vermont from 1990 - 2009 is 3.6%. (VSA)*
O & M.:	$75,000	in Year 1 $	*Estimate of additional electricity for feed system motors and additional maintenance staff time*
Major Repairs:	$2,500		*Contingency for major repair (e.g. refractory replacement) at Years 10, 20 and 30 annualized*

Yr.	Natural Gas Cost	Financing	Woodchip Fuel Cost	Partial Natural Gas Cost	O&M	Scheduled Repairs	Total	Annual Cashflow	Cumulative Cashflow
1	$253,296	$326,281	$135,732	$37,994	$75,000	$2,500	$577,508	-$324,212	-$324,212
2	$267,480	$326,281	$140,619	$40,122	$76,950	$2,565	$586,537	-$319,056	-$643,268
3	$282,459	$326,281	$145,681	$42,369	$78,951	$2,632	$595,913	-$313,454	-$956,722
4	$298,277	$326,281	$150,926	$44,742	$81,003	$2,700	$605,651	-$307,375	-$1,264,097
5	$314,980	$326,281	$156,359	$47,247	$83,110	$2,770	$615,767	-$300,786	-$1,564,883
6	$332,619	$326,281	$161,988	$49,893	$85,270	$2,842	$626,274	-$293,655	-$1,858,538
7	$351,246	$326,281	$167,819	$52,687	$87,487	$2,916	$637,191	-$285,945	-$2,144,483
8	$370,916	$326,281	$173,861	$55,637	$89,762	$2,992	$648,533	-$277,617	-$2,422,101
9	$391,687	$326,281	$180,120	$58,753	$92,096	$3,070	$660,319	-$268,632	-$2,690,733
10	$413,621	$326,281	$186,604	$62,043	$94,490	$3,150	$672,568	-$258,947	-$2,949,680
11	$436,784	$326,281	$193,322	$65,518	$96,947	$3,232	$685,299	-$248,515	-$3,198,195
12	$461,244	$326,281	$200,281	$69,187	$99,468	$3,316	$698,532	-$237,288	-$3,435,483
13	$487,074	$326,281	$207,492	$73,061	$102,054	$3,402	$712,289	-$225,215	-$3,660,698
14	$514,350	$326,281	$214,961	$77,152	$104,707	$3,490	$726,592	-$212,242	-$3,872,940
15	$543,154	$326,281	$222,700	$81,473	$107,430	$3,581	$741,464	-$198,311	-$4,071,251
16	$573,570		$230,717	$86,036	$110,223	$3,674	$430,650	$142,921	-$3,928,331
17	$605,690		$239,023	$90,854	$113,089	$3,770	$446,735	$158,955	-$3,769,375
18	$639,609		$247,628	$95,941	$116,029	$3,868	$463,466	$176,143	-$3,593,232
19	$675,427		$256,542	$101,314	$119,046	$3,968	$480,870	$194,557	-$3,398,676
20	$713,251		$265,778	$106,988	$122,141	$4,071	$498,978	$214,273	-$3,184,403
21	$753,193		$275,346	$112,979	$125,317	$4,177	$517,819	$235,374	-$2,949,029
22	$795,372		$285,258	$119,306	$128,575	$4,286	$537,425	$257,947	-$2,691,082
23	$839,912		$295,528	$125,987	$131,918	$4,397	$557,829	$282,083	-$2,408,999
24	$886,947		$306,167	$133,042	$135,348	$4,512	$579,068	$307,880	-$2,101,119
25	$936,617		$317,189	$140,492	$138,867	$4,629	$601,177	$335,440	-$1,765,679
26	$989,067		$328,607	$148,360	$142,477	$4,749	$624,194	$364,873	-$1,400,806
27	$1,044,455		$340,437	$156,668	$146,182	$4,873	$648,160	$396,295	-$1,004,511
28	$1,102,944		$352,693	$165,442	$149,982	$4,999	$673,116	$429,828	-$574,683
29	$1,164,709		$365,390	$174,706	$153,882	$5,129	$699,108	$465,602	-$109,082
30	$1,229,933		$378,544	$184,490	$157,883	$5,263	$726,179	$503,753	$394,672
Totals	$18,669,883	$4,894,213	$7,123,312	$2,800,482	$3,345,681	$111,523	$18,275,211	$394,672	
30 Yr. NPV at 7% Discount Rate	$5,905,348	$2,971,738	$2,476,880	$885,602	$1,220,912	$40,697	$7,596,030	-$1,690,682	

Total Annual Heating Costs	Natural Gas + Woodchips	Woodchip System O&M /Year	Contingency Allowance / Year	Woodchip + Partial NG + O&M + Contingency	Annual Fuel Cost Savings	Local Share Cost	Simple Payback (yrs)	30 Yr. NPV Savings	Annual Rate of Return
$253,296	$173,727	$75,000	$2,500	$251,227	$79,569	$2,971,738	37.3	($1,690,682)	0.1%

ADDITONAL ISSUES TO CONSIDER

ENERGY EFFICIENCY

Whether FiberMark converts to biomass or stays with natural gas, the facility should use its heating fuel efficiently. The New York State Energy Research and Development Authority (NYSERDA) and/or the New York Power Authority (NYPA) can help identify and prioritize appropriate energy efficiency projects that will improve the facility's infrastructure and save money. Both of these agencies can help with the evaluation of energy efficiency opportunities and provide financial incentives to upgrade and improve equipment efficiencies. If the facility decides to move forward with a biomass energy project, it should work with one of these agencies to identify other efficiency projects that could be completed at the same time.

General information on NYSERDA and NYPA programs is included in the *Biomass and Green Building Resources* binder accompanying this report.

An additional efficiency measure to consider is the possibility of capturing waste heat from the current dryer exhaust to generate hot water, reducing the demand on the existing hot water boiler.

CONVERTING OTHER HEATING NEEDS TO HOT WATER PROVIDED BY CENTRAL BOILER SYSTEM

There may be some potential for retrofitting other heat loads in the facility to using hot water produced from boilers. However, estimating costs for such conversions would be complicated and was beyond the scope of this study. While the average cost FiberMark paid for natural gas was over $9.00 per Dth, their most recent price was down below $7.00 per Dth. Woodchip fuel is only slightly less than that on a cost per Btu basis and probably is not worth considering. However, if natural gas prices increase dramatically, it may be worth re-evaluating the benefit of converting some or all of the other heat loads in the plant to hot water so that more of the load could be met using central boilers. One option to investigate is the possibility of using a steam coil in place of the current burner to provide hot air. If this replacement is possible, there would be significantly more savings associated with a biomass project decreasing the pay-back time to approximately 15 years.

In the appendices is a sensitivity analysis that demonstrates at what point woodchip heat may provide enough lifetime cost savings to justify the investment.

COMBINED HEAT AND POWER

Another option to consider is the installation of a biomass combined heat and power (CHP) system. While these systems have a larger capital cost (approximately $300,000 more than a heat-only system), a CHP system (using a backpressure steam turbine) could generate approximately 500,000 kW annually creating close to $60,000 in value annually. A CHP project would also be more likely to achieve

NYSERDA incentives to help offset upfront costs. However, it would still be a difficult project to implement based on fuel savings and capital costs.

COMMISSIONING

Commissioning of any new electrical or mechanical system provides quality assurance, identifies potential equipment problems early on and provides financial savings on utility and maintenance costs during system operations. A recent study of 224 buildings found that the energy savings from commissioning new buildings had a payback period of less than five years. Additional benefits of commissioning include: improved indoor air quality, fewer deficiencies and increased system reliability. See the *Biomass and Green Building Resources* binder for more information on commissioning.

PROJECT FUNDING POSSIBILITIES

GRANTS/FINANCING OPPORTUNITIES

USDA Rural Energy for America Program (REAP)

To help agricultural producers and rural small businesses purchase and install RE systems and energy efficiency improvements.

Eligible Small Businesses are to be located in a rural area and can not exceed SBA size standards by NAICS code:
http://www.sba.gov/idc/groups/public/documents/sba_homepage/serv_sstd_tablepdf.pdf.

Eligible technologies include wind, solar, biomass, geothermal, hydrogen, small hydro and energy efficiency. The projects are limited to commercial and pre-commercial (no R&D). Residential property is not eligible for Rural Energy for America grants or loans.

Grant – The grant can cover up to 25% of eligible project costs with a minimum grant amount of $2,500 and a maximum grant amount of $500,000.

Guaranteed Loan – Guaranteed loans can be used for working capital, land acquisition and costs related to the Renewable Energy system. Loans can cover a maximum of 75% of project costs. The maximum loan amount is $25 million. Borrower equity of 15% is required for guaranteed loans less than $600,000 and 25% for guaranteed loans greater than $600,000 (some borrower equity can be covered by a REAP grant, see below).

Combination Grant/Guaranteed Loans – Combine Grant and Guaranteed Loans cannot exceed 75% of total project costs. The minimum combine funding level is $80,000 with the grant covering a minimum of $20,000. The grant amount contributes to the borrower equity percentage in the project.

USDA Business and Industry Guaranteed Loans (B&I)

The purpose of the B&I Guaranteed Loan Program is to improve, develop, or finance business, industry, and employment and improve the economic and environmental climate in rural communities. This purpose is achieved by bolstering the existing private credit structure through the guarantee of quality loans which will provide lasting community benefits. It is not intended that the guarantee authority will be used for marginal or substandard loans or for relief of lenders having such loans.

Eligible borrowers must be a cooperative organization, corporation, partnership, or other legal entity organized and operated on a profit or nonprofit basis. The borrower must be engaged in or proposing activities which improve the economic or environmental climate and/or reduce reliance on nonrenewable energy resources by encouraging the development and construction of solar energy systems and other renewable energy systems.

The maximum loan amount is $10 million. The maximum percentage of guarantee for the loan is 80% for loans of $5 million or less and 70% for loans between $5 million and $10 million. Machinery and equipment loans must be repaid in 7 years or less.

For more information on USDA grants and loans contact:
Karen McDonnell | Rural Business Cooperative Specialist
USDA Rural Development
315-4776426 | 315-477-6448 Fax
beverly.vonpless@ny.usda.gov

NYSERDA

NYSERDA's **FlexTech Program** provides New York State commercial, industrial, institutional, government, and not-for-profit sectors with objective and customized information to help customers make informed energy decisions. FlexTech's goal is to increase productivity and economic competitiveness of participating facilities by identifying and encouraging the implementation of cost-effective energy efficiency, carbon reduction measures, peak-load curtailment, and CHP and renewable generation projects. All projects must include cost-sharing in the form of matching cash support from the applicant. For most applications, NYSERDA will contribute fifty percent (50%) of the eligible study costs, up to the lesser of either $1,000,000 or ten percent (10%) of the applicant's annual energy costs, based on an approved Scope of Work. The full Program Opportunity Notice (PON), including an application, is available in the *Biomass and Green Building Resource Binder* or online at:
http://www.nyserda.org/Funding/1746pon.asp

For more information contact Jeff Peterson, Energy Resources Project Manager at:
NYSERDA
17 Columbia Circle
Albany, NY 12203
518-862-1090 x3288 | 518-862-1091 Fax
jmp@nyserda.org

FEDERAL TAX INCENTIVES

MACRS Accelerated Deprecation

Under the federal Modified Accelerated Cost-Recovery System (MACRS), businesses may recover investments in certain property through depreciation deductions. The MACRS establishes a set of class lives for various types of property, ranging from three to 50 years, over which the property may be depreciated. For certain biomass property, the MACRS property class life is seven years. Eligible biomass property generally includes assets used in the conversion of biomass to heat or to a solid, liquid or gaseous fuel, and to equipment and structures used to receive, handle, collect and process biomass in a waterwall, combustion system, or refuse-derived fuel system to create hot water, gas, steam and electricity.

For more information on Federal tax incentives, see the Database of State Incentives for Renewable Energy Website at:
http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US06F&re=1&ee=1

THERMAL

At the time this report was written there were no tax credits available for commercial installation of thermal biomass heating systems. However there is legislation pending in Congress that could change this situation. The Biomass Thermal Energy Council (BTEC) does a good job of keeping up-to-date on all biomass-related legislation, including tax credits. You can visit their website for the most up-to-date information: http://www.biomassthermal.org/legislative/. The following bills are pending:

S. 3188 – American Renewable Biomass Heating Act of 2010

This bill would establish a corporate tax credit equal to 30% of the installed cost of biomass heating systems for commercial or industrial applications, with no maximum credit. To qualify for the credit, boilers and furnaces would be required to operate at greater than 75% efficiency and provide thermal energy for space heating, air conditioning, domestic hot water, or industrial process heat.

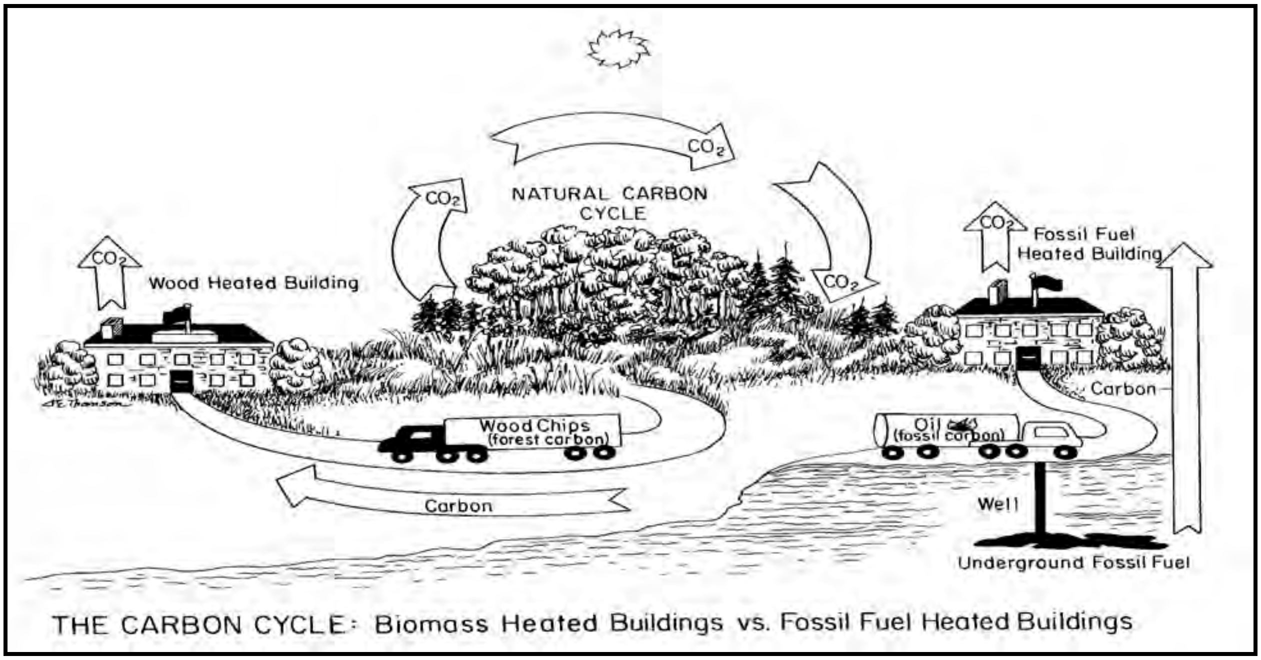
S. 1094 – REAP Act

This bill would amend the Renewable Energy Alternative Production (REAP) Act to include a credit for the production of non-electric renewable energy, including thermal energy.

CARBON OFFSETS

While fossil fuels introduce carbon that has been sequestered for millions of years into the atmosphere, the carbon dioxide emitted from burning biomass comes from carbon that is already above the ground and in the carbon cycle. Biomass fuels typically come from the waste of some other industrial activity such as a logging operation or from sawmill production. The carbon from this waste would soon wind up in the atmosphere whether it was left to decompose or it was burned as slash. There are few measures FiberMark could undertake that would reduce its carbon footprint more than switching their heating fuel use from natural gas to a biomass fuel.

Figure 5: Carbon Cycle Illustration[2]



Carbon offsets help fund projects that reduce greenhouse gases emissions. Carbon offset providers sell the greenhouse gas reductions associated with projects like wind farms or biomass projects to customers who want to offset the emissions they caused by flying, driving, or using electricity. Selling offsets is a way for some renewable energy projects to become more financially viable. Buying offsets is a way for companies and individuals to compensate for the CO_2 pollution they create.

For a biomass heat-only project, a Btu-for-Btu displacement of heating fuel (based on historic purchase records) by biomass is assumed over the project's predicted operating life. CO_2 avoidance is based on the emissions profile (Lbs. CO_2 /Btu) of the displaced fuel. The US EPA calculates that 11.7 lbs. of CO_2 is produced from each therm of natural gas consumed (equivalent to 117 lbs per Dth). It is projected that FiberMark can offset approximately 23,000 Dth of natural gas per year by replacing that energy using biomass. This is equivalent to about 1,350 tons of CO_2. The market value of this type of offset is between \$3/ton and \$5/ton. These offsets can be negotiated as either a lump sum offset for up to 10 years or can be paid out as an annual payment. This could mean annual payments of \$4,000 - \$6,750 or a lump sum up front payment of as much as \$40,000 to \$67,500.

There are a number of companies that are interested in contributing to the construction of new sources of clean and renewable energy through carbon offsets. Information about carbon offsets is included in the *Biomass and Green Building Resources* binder accompanying this report.

[2] Illustration taken from a handout produced by the Biomass Energy Resource Center

PERMITTING

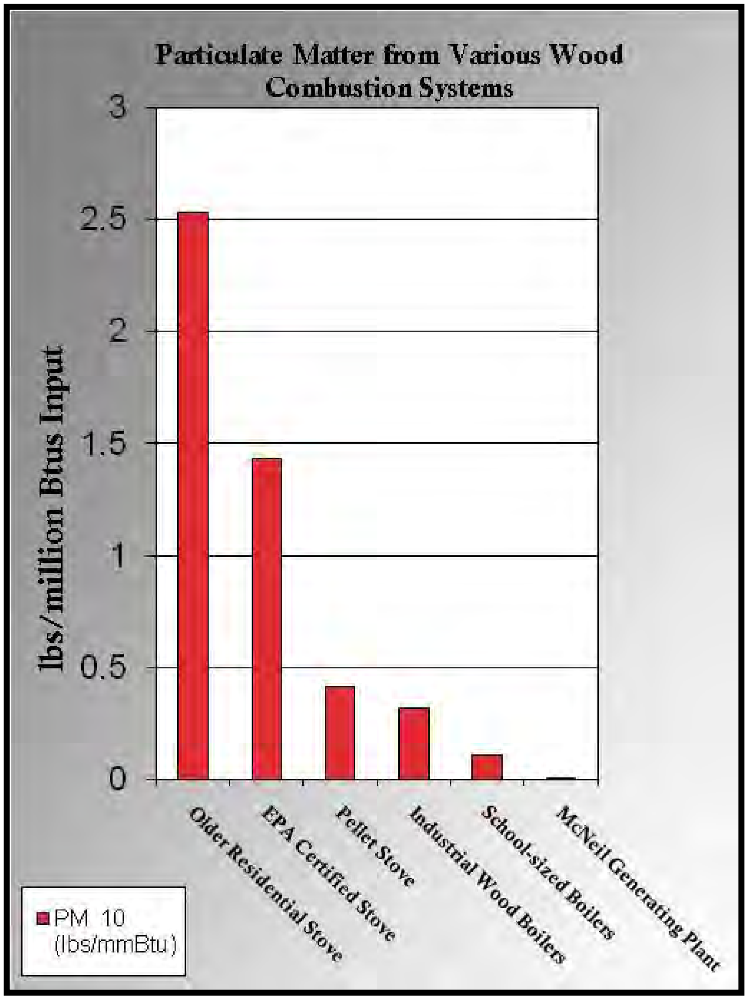
Modern biomass boiler technology is both clean and efficient. Controls moderate both the biomass fuel and air to create either a small hot fire or a large hot fire depending on heat demand from the building. Under full load, modern woodchip boilers routinely operate at steady state efficiencies of 70% – 75%. Operating temperatures in commercial scale biomass boilers can reach up to 2,000 degrees and more, completely eliminating creosote and the need to clean stacks. The amount of ash produced from a 25 ton tractor trailer load of green hardwood chips can fit in a 25 gallon trash can, is not considered a hazardous waste and can be used as a soil amendment on lawns, gardens and playing fields.

However, as with any combustion process, there are emissions from biomass boilers. There is no question that natural gas is the cleanest boiler fuel used for heating. However, biomass compares favorably with fuel oil and modern commercial scale biomass boilers with the appropriate pollution control devices can burn very cleanly and efficiently.

As with any combustion process, there are emissions from biomass boilers. The pollutant of greatest concern with biomass is particulates (PM_{10}). While biomass compares reasonably well with natural gas, biomass boilers clearly generate more particulates. That is why it is important to install appropriate pollution control equipment. Many modern types of emission control equipment, capable of reducing particulate matter emissions from 50-99 percent, are commercially available in the US. The most common emission control equipment technologies are baghouses, cyclones, multi-cyclones, electrostatic precipitators, and wet scrubbers. Appropriate emission control equipment technologies should be identified in consultation with local air quality regulators. The emissions from a modern woodchip boiler are much less than most people think.

One of the most common misconceptions about institutional/commercial biomass energy systems comes from the experience people have with residential wood stoves and outdoor wood boilers. In general, an institutional/commercial-scale wood energy system emits only one fifteenth (seven percent) the PM_{10} of the average wood stove on a Btu basis. Over the course of a year, a large, woodchip heated school in a climate like Vermont may have the same particulate emissions as four or five houses heated with wood stoves.

Figure 6: Particulate Emissions[3]



New EPA Regulations

On April 29, 2010, the Environmental Protection Agency (EPA) issued a proposed rule that would reduce emissions of toxic air pollutants from existing and new industrial, commercial and institutional boilers located at area source or major source facilities. An area source facility emits or has the potential to emit less than 10 tons per year (tpy) of any single air toxic or less than 25 tpy of any combination of air toxics. The major source facility emits or has the potential to emit 10 or more tpy of any single air toxic or 25 tpy or more of any combination of air toxics.

The proposal would set different requirements for large and small boilers at the area source facility. Large boilers have a heat input capacity equal to or greater than 10 mmBtu/hr and small boilers have a heat input capacity less than 10 mmBtu/hr. The biomass fired new boilers would need to meet limits for PM and CO. For the major source facility, EPA has identified 11 different subcategories of boilers and process heaters based on the design of the various types of units. The proposed rule would include specific requirements for each subcategory.

Details on the status of this proposal will be posted at www.epa.gov/airquality/combustion/.

In order to install a new woodchip boiler, it is likely that the company will need to obtain an air quality permit or an amendment to an existing permit. For a woodchip boiler, the permit would likely include requirements for pollution control equipment, such as a bag house or an electrostatic precipitator along with a requirement for a tall stack to help with dispersion. Costs for pollution control equipment and a tall stack are included in the cost estimates for the woodchip scenario analyzed in this report. Other permit conditions might include testing for emissions and efficiency, keeping records of fuel consumption and test results and making periodic submittals to regulatory agencies.

[3] Excerpted from a handout produced by the Biomass Energy Resource Center.

CONCLUSIONS AND RECOMMENDATIONS

FiberMark does not appear to be a strong candidate for a woodchip heating system. While the site is well-suited for a stand-alone woodchip boiler house and chip storage, the potential fuel savings are not large enough to offset the capital investment for this facility. The analysis provided in this report indicates that FiberMark could save nearly $80,000 in fuel costs in the first year, but that the financing costs would be considerably greater than the fuel savings.

Unless grant funding or tax incentives can be used to substantially decrease the capital costs of a biomass project, Yellow Wood does not recommend moving forward with a biomass heat project at this time. The *Additional Issues to Consider* section of this report does outline potential opportunities for making a biomass system more attractive, including converting the direct-fired dryer to a steam coil and investigating the opportunities associated with a Combined Heat and Power project. There are also likely energy efficiency opportunities that FiberMark could investigate that could offer very good rates of return. To investigate these energy efficiency opportunities Yellow Wood recommends that NYSERDA be engaged to develop comprehensive energy efficiency recommendations and proposals for incentives for efficiency upgrades. Information on NYSERDA programs is included in the *Biomass and Green Building Resources* binder accompanying this report.

WHO WE ARE

Yellow Wood Associates

Yellow Wood Associates (Yellow Wood) is a woman-owned small business specializing in rural community economic development since 1985. Yellow Wood has experience in green infrastructure, program evaluation, business development, market research, business plans, feasibility studies, and strategic planning for rural communities. Yellow Wood provides a range of services that include measurement training, facilitation, research, and program management.

Richmond Energy Associates

Richmond Energy Associates was created in 1997 to provide consulting services to business and organizations on energy efficiency and renewable energy program design and implementation. Richmond Energy has extensive experience in wood energy systems. Jeff Forward provides analysis and project management on specific biomass projects and works with state, regional and federal agencies to develop initiatives to promote biomass utilization around the country. In addition to his own consulting business, he is also a Senior Associate with Yellow Wood.

APPENDICES

DISCUSSION OF BIOMASS FUELS

Purchasing wood fuel is a different exercise than purchasing natural gas. While natural gas is delivered to the site with little interaction from facility managers, biomass fuel suppliers will need to be cultivated and educated about the type of fuel needed, its characteristics and the frequency of deliveries. Concurrently with designing a wood-energy system, FiberMark should also be cultivating potential biomass fuel suppliers

Potential wood fuel suppliers include sawmills, loggers, chip brokers and large industrial users such as paper mills or power plants. Many of these forest products producers already make woodchips for pulp and to reduce waste, but may not have much experience dealing with the needs of smaller volume customers. Woodchips produced for institutional/commercial biomass boilers have more stringent specifications than those produced for large industrial customers. And woodchip fuel may need to be delivered in different trailers.

When talking to potential woodchip fuel suppliers, it is important to have the wood fuel specification in mind. A one to three inch square chip is ideal. If possible, woodchips for institutional/commercial biomass systems will come from logs that are debarked prior to chipping because bark produces more ash which translates into a little more daily maintenance. Pieces or small branches that are six inches or longer can jam augers and conveyors which will interrupt the operation of automated fuel handling equipment. Institutional/commercial scale biomass boiler systems in the Northeast are typically designed to operate with wood fuel that is within a 35% to 45% range for moisture content.

Typically institutional/commercial biomass systems of this scale have limited chip storage capacity which means they may need deliveries on relatively short notice. Woodchip fuel suppliers will need to be within a 100 to 150 mile radius or so of the user, the closer the better, as transportation costs will affect price. Chip deliveries are typically made in "live bottom" trailers that will self unload into below-grade chip storage bins. Therefore, potential suppliers must have access to a self-unloading trailer for deliveries.

It is possible to design a wood-energy system that uses any one of a variety of biomass fuels, but green hardwood chips make the best fuel. If it is readily available, it should be the fuel of choice. In addition, users should focus on reliability of supply and consistency of the fuel rather than just lowest cost. The goal should be to minimize maintenance and optimize system performance.

Whichever fuel is used, the fuel type needs to be part of the combustion system design process, and the wood system should be operated using the fuel it is set up to use. Ideally, sample fuel chips should be sent to the manufacturer of the biomass heating equipment so that they can design the fuel handling equipment around the type of fuel and calibrate the system properly when setting the system up. No system handles widely varying fuel types at the same time very well. A system can be re-calibrated for a different fuel type, but the most practical approach is to stick with one fuel type, at least for a given heating season. If, for some reason, that fuel type becomes unavailable, the manufacturer of the equipment should be consulted to help reconfigure or retune the system for another fuel.

It is best to try to locate several potential suppliers. By doing so, FiberMark will have the security of knowing there will be back-up in case of an interruption from their primary supplier. This will also generate some competition. Contact the New York State Forest Utilization Program for a list of local suppliers.

The bottom line is that both FiberMark and fuel suppliers need to clearly understand the characteristics of fuel needed for their particular system. Consistent particle size and moisture content is particularly important for institutional/commercial customers, and FiberMark should insist on the quality of the chip. A sample fuel specification is included in the *Biomass and Green Building Resources* binder to give an idea of the types of characteristics to look for in woodchip fuel. Below is a description of the advantages and disadvantages of different types of biomass fuels in order of preference.

Green Hardwood Chips

A consistent green hardwood chip is the easiest fuel for institutional/commercial scale automated biomass heating systems to handle. Rarely will they jam an auger or conveyor. Green chips burn somewhat cooler than most other biomass fuels making it easier to control the combustion. With proper controls, they burn very cleanly with minimal particulate emissions and little ash. They have less dust than other biomass fuels so they are less messy and safer to handle. Ideally moisture content will be between 35% and 45% on a wet basis. Green hardwood chips can come from sawmill residues or timber harvest operations.

Mill Residues vs. Harvest Residues

Woodchips can be produced at sawmills or other primary wood products industrial sites as part of their waste wood disposal process. Mill residues are typically the most desirable source of fuel woodchips. Mills can produce a bark-free chip with few long pieces or branches that can jam augers and fuel conveyors. A mill supplier can easily calculate trucking costs and can negotiate dependable delivery at a consistent price.

Another potential type of wood fuel is whole tree chips which are produced as part of tree harvesting. Whole tree chips tend to be a dirtier fuel than sawmill residues and may contain small branches, bark, twigs and leaves. The longer pieces can jam the relatively small augers of an institutional/commercial scale biomass system and can add to the daily maintenance because they produce more ash.

The bole of a tree is the de-limbed trunk or stem. Chips made from boles are in-between the quality of a sawmill chip and a whole tree chip. Bole-tree chips tend to have fewer twigs and long stringers than whole tree chips. Both bole-chips and whole-tree chips can be potentially good sources for biomass fuels, although they have a greater likelihood of including oversized chips and they will produce somewhat more ash, compared to mill residues.

Softwood Chips

Green softwood chips will generally have less energy and more water content per truckload, and therefore they will be more expensive to transport than hardwood chips. As long as the combustion and fuel handling equipment is properly calibrated for softwood chips, an automated woodchip heating system can operate satisfactorily with softwood chips. Softwoods tend to have higher moisture contents and can range up to 60% moisture on a wet basis. The best biomass fuel will have less than 50% moisture. One species to avoid altogether is white pine. It has a very high moisture content and therefore relatively low bulk density. The experience in Vermont schools with white pine is that it is a poor biomass fuel for institutional/commercial-scale woodchip systems.

Dry Chips vs. Green Chips

Dry chips (less than 20% moisture on a wet basis) burn considerably hotter than green chips and typically have more dust. The increased operating temperature can deteriorate furnace refractory faster increasing maintenance costs slightly. The dust can make for a somewhat dirtier boiler room which will be a problem for some maintenance staff. Dry chips are also easier to accidentally ignite in the fuel storage bin or fuel handling system. If dry chips are used, the combustion equipment needs to be carefully calibrated to handle these higher temperatures. Dry chips are not generally recommended for institutional/commercial settings.

Bark

Bark has a high energy value, but it also comes with significant maintenance costs. It produces a considerable amount of ash that needs disposal; it can create more smoke than green chips; and it can cause other routine maintenance problems such as frequent jamming of augers from rocks. Bark can be an inexpensive fuel, but the additional maintenance costs make it unattractive for institutional/commercial biomass systems.

Sawdust and Shavings

Sawdust and shavings should ordinarily be ruled out for the institutional/commercial wood heating market. Dry sawdust can be dusty to handle and raises fire safety and explosion issues. Shavings are also dusty and easily ignited and are difficult to handle with typical fuel handling equipment. This fuel type can work fine in an industrial setting, but institutions typically do not have the maintenance staff that can provide the supervision that these fuels need.

SENSITIVITY ANALYSIS

Table 4: Wood and Natural Gas Prices Vary - Interest and Inflation Rates Held Constant

	Natural Gas Prices/Dth				
Wood Price/ton	**$7.00**	**$8.00**	**$9.00**	**$10.00**	**$11.00**
$40	$57,395	$81,107	$104,818	$128,530	$152,242
$45	$43,822	$67,534	$91,245	$114,957	$138,668
$50	$30,249	$53,960	$77,672	$101,384	$125,095
$55	$16,676	$40,387	$64,099	$87,810	$111,522
$60	$3,102	$26,814	$50,526	$74,237	$97,949

Annual Fuel Cost Savings shown

Table 5: Interest and Natural Gas Inflation Vary - Wood Fuel and General Inflation Rate Constant

	Fuel Inflation Rate (%)			
Interest Rate (%)	**2.6%**	**4.6%**	**6.6%**	**8.6%**
3.0%	-$3,573,452	-$1,592,214	$1,278,378	$5,472,358
4.0%	-$3,462,914	-$1,841,397	$488,108	$3,865,699
5.0%	-$3,375,083	-$2,039,435	-$137,366	$2,598,727
6.0%	-$3,304,926	-$2,197,682	-$635,010	$1,594,526
7.0%	-$3,248,591	-$2,324,823	-$1,033,036	$794,519

30 yr NPV shown

POTENTIAL BIOMASS FUEL SUPPLIERS

Active providers of woodchip fuel change regularly. For the most up-to-date information on potential providers, contact the New York State Forest Utilization Program:

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Program Leader
NYS Forest Utilization Program
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