U.S. Department of Agriculture
Northeastern Area
State and Private Forestry

WERC
WOOD EDUCATION AND RESOURCE CENTER
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Preliminary Feasibility Report

Biomass Heating Analysis for Clifton-Fine Hospital

Star Lake, New York

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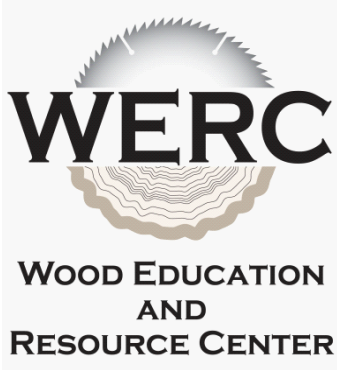


The Wood Education and Resource Center is located in Princeton, W.Va., and administered by the Northeastern Area State and Private Forestry unit of the U.S. Department of Agriculture Forest Service. The Center's mission is to work with the forest products industry toward sustainable forest products production for the eastern hardwood forest region. It provides state-of-the-art training, technology transfer, networking opportunities, applied research, and information. Visit www.na.fs.fed.us/werc for more information about the Center.

Table of Contents

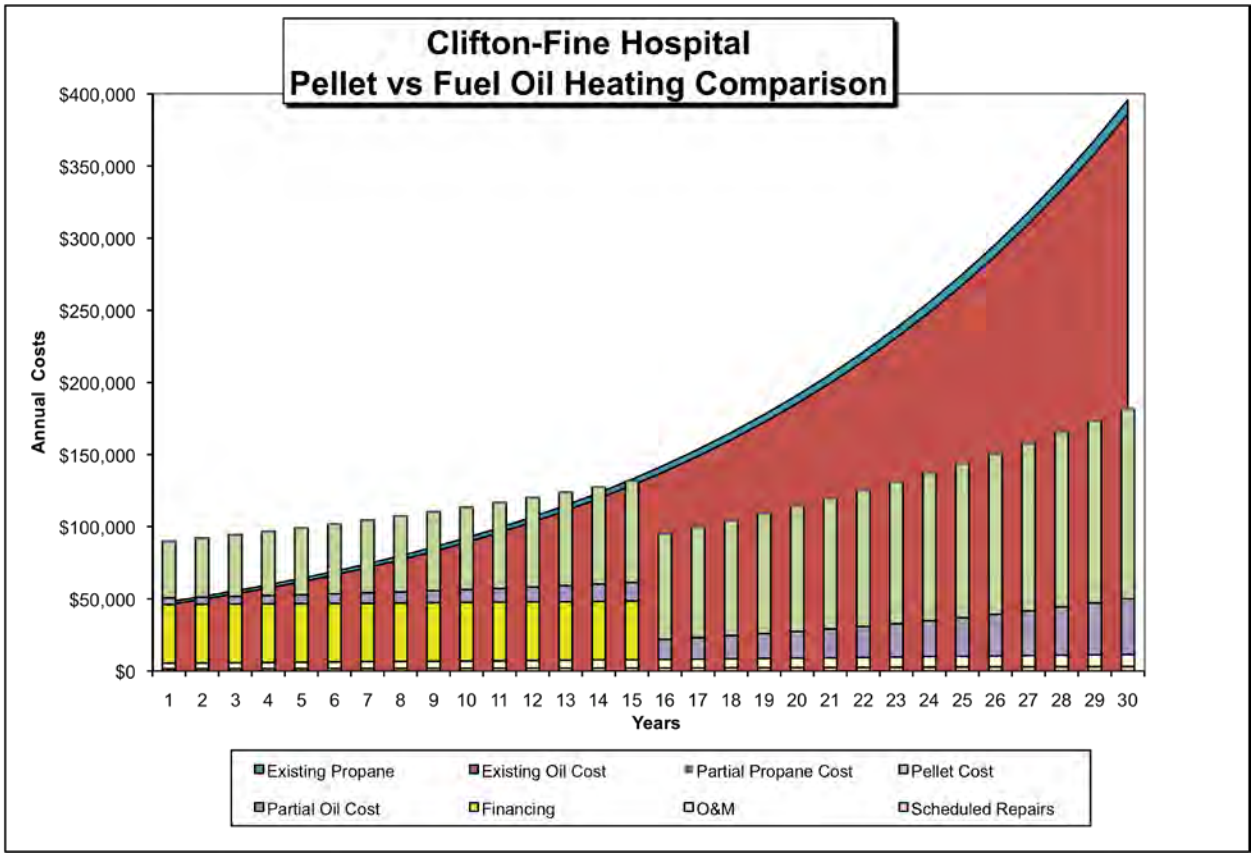
List of Figures

List of Tables

EXECUTIVE SUMMARY

Clifton-Fine Hospital is a small rural hospital with 40 beds and offers a variety of emergency and outpatient services in Star Lake, New York. The hospital has approximately 25,000 square feet of building space and is in the process of building a 6,500 SF addition. The main hospital is currently heated by three hot water boilers that run on fuel oil which will also heat the new addition.

The hospital currently uses approximately 18,000 gallons of fuel oil for the existing hospital building. We estimate the new addition will need approximately 4,500 gallons of additional fuel oil. At the average price of $2.05 per gallon of fuel oil paid by the hospital in the past two years, the hospital will spend more than $46,000 on fuel costs this coming year.



The hospital also has a separate 3,500 square foot maintenance building on site that has its own propane fueled heating system. This building uses about 1,060 gallons of propane each year for heat at an average price of $1.81/gallon. For this analysis we included costs and savings for connecting the two buildings to the central boiler plant in the main hospital

The analysis provided in this report indicates that Clifton-Fine Hospital could save over $500,000 in operating costs over 30 years in today's dollars even when the cost of financing is included. However, all of these savings are achieved in the later half of the 30-year analysis period and annual operating costs would actually rise in the early years.

Yellow Wood recommends taking the following steps if the hospital wants to investigate this opportunity further:

1. While the fuel cost savings for this project are reasonable over time, several things could make this project more financially attractive.
    a. The Clifton-Fine Central School is also considering a pellet boiler installation. Hospital and school facility managers should consider negotiating bulk purchasing of pellet fuel together in order to get a better price.
    b. If the hospital were to find grants that helped offset project costs or lower interest loans to finance the project, then obviously the economics of the project could improve. There is a section in the report that highlights several potential funding sources.
2. If the hospital wants to move forward with a project they will need to hire an engineering firm to help refine the project concept and to obtain firm local estimates on project costs. It is possible that a local engineering firm might be able to find installation cost savings that could make this project more financially attractive. The US Forest Service may be able to provide some engineering technical assistance from an engineering team with biomass experience that is part of the program that funded this study. If the facility moves forward with this project, they should contact Lew McCreery, the US Forest Service Biomass Coordinator for the Northeastern Area to see what assistance can be provided. His contact information is: 304-285-1538, lmccreery@fs.fed.us.
3. The engineering team should investigate whether or not it truly would be cost effective to add the maintenance building to the central heating system in the main hospital building. If this can be done for less than $20,000, then the net present value savings for the project will improve.
4. The hospital should identify any heating system improvements it plans to undertake and consider including those projects with the biomass project. It will be more cost effective to implement boiler room upgrades and heating distribution improvements concurrent with the installation of a new boiler system than it would be to postpone those improvements for a later time.
5. Costs for an electrostatic precipitator pollution control device were included in the analysis for this report. If the facility moves forward with this project, the engineering design team should determine exactly what pollution control equipment would be required for the particular boiler equipment selected.

6. The New York State Energy Research and Development Authority (NYSERDA) and/or the New York Power Authority (NYPA) should be engaged to develop comprehensive energy efficiency recommendations and proposals for incentives for efficiency upgrades before undertaking a major building project. This should be done regardless of whether or not the hospital moves ahead with a biomass project at this time. Information on energy efficiency programs is included in the *Biomass and Green Building Resources* binder accompanying this report.

7. In order to effectively measure progress toward energy efficiency goals historical energy consumption data should be collected and updated frequently. There are many tools to help the hospital accomplish this. One such tool is the EPA Energy Star *Portfolio Manager* software. It is free public domain software that helps facility managers track energy and water use. This software can be downloaded at: http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager

8. Concurrent with the design of a biomass project, the hospital should investigate potential wood pellet fuel providers. The New York State Forest Utilization Program maintains an up-to-date list of biomass fuel suppliers. Their contact information is included in the appendices at the end of this report.

This preliminary feasibility study was prepared by Yellow Wood Associates in collaboration with Richmond Energy Associates, LLC for the Clifton-Fine Hospital. 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 the Clifton-Fine Hospital outlining whether or not wood pellet heating makes sense for this facility from a practical perspective. In June 2010, staff from Yellow Wood Associates traveled to Star Lake, NY to tour the hospital. 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

Clifton-Fine Hospital is a small rural hospital with 40 beds and offers a variety of emergency and outpatient services in Star Lake, New York. The hospital has approximately 25,000 square feet of building space and is in the process of building a 6,000 SF addition. The main hospital is currently heated by three 1.0 mmBtu hot water boilers in a central boiler plant that runs on fuel oil. The addition will be tied in to the central boiler plant, which has adequate capacity to handle the new load. There is also a 3,500 square foot maintenance building on site that is within 50 feet of the main hospital building. The adjacent maintenance building is heated by propane.

The hospital currently uses approximately 18,000 gallons of fuel oil and 1,060 gallons of propane each year to heat its buildings. The new addition will use approximately 4,500 gallons of fuel oil.

DESCRIPTION OF THE PROPOSED BIOMASS SYSTEM

The pellet scenario that was analyzed for this facility envisions adding a 1.7 mmBtu wood pellet boiler to the hospital's existing heating system and interconnecting with the existing heating system in the hospital

as well as the heating system in the addition. It appears there is enough room to install a new pellet boiler in the existing boiler room. Costs were included to connect this central system to the maintenance building via underground piping

The scenario this report analyzes includes the installation of a pellet boiler system in the existing boiler room which would provide 90% of the annual heating needs for the main hospital building, the new addition and the maintenance building. Included in the proposed capital costs are costs for a separate stack for the pellet boiler, a thirty-ton silo to store wood pellet fuel, an electrostatic precipitator pollution control device and interconnection with the existing heating distribution system. It was assumed that the existing boilers would be used for back-up and supplemental heat during the coldest months and that they would cover 10% of the annual heating load.

A woodchip heating system scenario was not analyzed for this report. While woodchip fuel is roughly half the cost of pellet fuel on a cost/Btu basis, the infrastructure is considerably more costly. It was felt that the current fuel use at the hospital and the price they pay for fuel oil was too low to make a woodchip system economic and therefore one was not worth analyzing for this report.

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 different scenarios over a 30-year horizon and takes into consideration life cycle cost factors. A 30-year time frame is used because it is the expected life of a new boiler.

The alternative biomass scenario envisions installing a new wood pellet heating system that would serve the Clifton-Fine Hospital. The scenario includes all ancillary equipment and interconnection costs. Under the biomass scenario, the existing fuel oil and propane boilers would still be used to provide supplemental heat during the coldest days of the year if necessary and potentially for the warmer shoulder season months when buildings only require minimal heating during chilly weather.

The analysis projects current and future annual fuel oil and propane heating 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.

CAPITAL COST ASSUMPTIONS FOR WOOD PELLET SCENARIO

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, Clifton-Fine Hospital 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.

FUEL OIL COST ASSUMPTIONS

Fuel bills provided by Clifton-Fine Hospital indicate that the hospital uses an average of 18,000 gallons of fuel oil per year to heat the main hospital building being considered in this analysis. It is assumed that the addition would use an additional 4,500 gallons of fuel oil annually. (This number is based on the current fuel oil used per square foot at the hospital.) This results in an assumed annual fuel consumption of 22,500 gallons – this is the amount used as the base case in the analysis. Over the past two years, the hospital paid an average of $2.05 per gallon for fuel oil, this is the price used in the base case analysis. At that price, the hospital will spend more than $46,125 for fuel oil to heat this building next year.

PROPANE COST ASSUMPTIONS

Additional fuel bills provided by the hospital indicate that Clifton-Fine Hospital uses an average of 1,060 gallons of propane per year to heat the additional maintenance building being considered in this analysis. This is the amount used as the base case in the analysis. Over the past two years, the hospital paid an average of $1.81 per gallon for propane, this is the price used in the base case analysis. At that price, the hospital will spend an additional $1,919 for propane next year.

WOOD PELLET FUEL COST ASSUMPTIONS

Pellet fuel is a manufactured product that competes directly with fossil fuels. Consequently pellet fuel prices track more closely to fossil fuels than other biomass fuel. Pellets prices also fluctuate more

dramatically than woodchips. However, pellets are still a relatively local product so they won't likely have the same geopolitical pressures as fossil fuels. After consulting with several suppliers in the area, we are projecting a first year cost of $225 per ton for pellets, which is equivalent to about $1.88 per gallon for fuel oil and $1.20 per gallon for propane.

The pellet scenario assumes the facility will meet 90% of its winter heating needs with pellets and therefore consume approximately 175 tons of pellets per year at $225 per ton in the first year. The remaining 10% of the heating needs were then assumed to be provided by #2 fuel oil and propane, consuming about 2,250 gallons of fuel oil and 106 gallons of propane per year. The costs for supplemental fuel oil, propane and pellets are then adjusted for inflation each year over the thirty 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 Fuel Oil in New York was 7.6% per year. The analysis projects this average inflation rate for fuel oil forward over the thirty-year analysis period. The hospital's fuel rate of $2.05/gallon was used for the first year of the analysis and then inflated each year at 7.6%. Using the same methodology for propane we found the average annual increase for propane over the last twenty years was 5.8%. The hospital's two-year average cost of propane at $1.81/gallon was used in the first year of the analysis and then inflated at 5.8% per year.

Pellet fuel pricing tends to track that of fossils fairly closely for two reasons. First it takes a considerable amount of energy to produce pellets. Woodchip and sawdust feedstock need to be dried, which requires energy, and then it also takes energy to compress the feedstock into pellets. Second, wood pellet fuel is used almost exclusively as a heating fuel. It competes directly with fossil fuels used for heat. While it is true that wood pellet fuel tends to be produced relatively locally and therefore has less geopolitical volatility than fossil fuels, there does appear to be a link between pellet fuel prices and fuel oil prices. The Biomass Energy Resource Center uses 4.25% as an inflation factor for pellet fuel. This is somewhat more than the average rate of inflation for woodchip fuel over the past twenty years but less than the average inflation rate for fuel oil. For this analysis it was assumed that wood pellet fuel would inflate at 4.25% per year.

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.

OPERATION AND MAINTENANCE ASSUMPTIONS

Pellet boilers require very little maintenance in comparison to woodchip boilers. For this biomass scenario it was assumed that existing on-site staff would spend on average approximately one hour per week in addition to their current boiler maintenance for 26 weeks per year and 20 hours during the summer months for routine maintenance. At a loaded labor rate of $25/hr this equals $1,150 annually. An additional $2,850 in annual operational costs is assumed for electricity to run pumps and motors and for the electrostatic precipitator.

Another operations and maintenance cost that is included in the analysis is periodic repair or replacement of major items on the pellet boiler such as the furnace refractory. It is reasonable to anticipate these types of costs on a 10-15 year cycle. For this analysis, $15,000 of scheduled maintenance was anticipated in years 10, 20 and 30 and then annualized at $1,500 per year to simulate a sinking fund.

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. 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 boilers were taken into consideration as these are considered costs that the facility would have paid anyway. It was assumed that all costs for the operation and maintenance of a biomass boiler are incremental additional costs.

FINANCING ASSUMPTIONS

Financing costs were included in the analysis to give facility decision makers a sense of how this project may impact their annual budget. Non-profit institutions often have access to long-term, tax exempt financing. It was assumed that the Clifton-Fine Hospital would be able to obtain a 15-year low-interest loan for the capital costs for the biomass project at an interest rate of 3%. The payment schedule that was used requires equal annual fixed payments over 15 years that include both principal and interest. Other financing schedules could create even more favorable cash flows depending on how much of the project costs are financed and how the remaining financing is structured. If the hospital were to forego financing and pay for the project outright, the annual savings would be considerably greater.

BIOMASS SCENARIO ANALYSIS

The analysis provided in this report indicates that Clifton-Fine Hospital could save over $500,000 in operating costs over 30 years in today's dollars even when the cost of financing is included. However, all of these savings are achieved in the later half of the 30-year analysis period and annual operating costs would actually rise in the early years.

Table 1: Wood Pellet Scenario Analysis Assumptions

Clifton-Fine Hospital	
Capital Cost Assumptions	
1.7 mmBtu pellet hot water boiler system including installation	$200,000
30 ton pellet storage silo	$15,000
Thermal Storage 1,700 gallon	$17,000
Interconnect to existing boiler system	$10,000
Pollution control equipment	$100,000
GC markup at 10%	$34,200
Construction contingency at 15%	$56,430
Design at 12%	$51,916
Total estimated project costs	**$484,546**
Financing Costs	
Financing, annual interest rate	3.0%
Finance term (years)	15
1st full year debt service	$40,589
Fuel Cost Assumptions	
Current annual fuel oil consumption in gallons	22,500
Assumed fuel oil price per gallon	$2.05
Projected annual fuel oil bill	$46,125
Current propane consumption in gallons	1,060
Assumed propane price per gallon	$1.81
Projected annual propane bill	$1,919
Assumed pellet price in 1st year (per ton)	$225
Projected 1st year pellet fuel bill	$39,286
Projected 1st year supplemental fuel oil bill	$4,613
Projected 1st year supplemental propane bill	$192
Inflation Assumptions	
General inflation rate (twenty year average CPI)	2.6%
Fuel oil inflation rate (twenty year EIA average for fuel oil in New York)	7.6%
Propane inflation rate (twenty year EIA average for propane in New York)	5.8%
Pellet inflation rate (Estimate from Biomass Energy Resource Center)	4.25%
O&M Assumptions	
Annual pellet O&M cost, including electricity for additional pumps and motors and staff time for daily and yearly maintenance	$4,000
Major repairs (annualized)	$1,500
Savings	
Net 1st year fuel savings	**($1,546)**
Total 30 year NPV cumulative savings	**$514,455**

Figure 1: Annual Cash Flow Graph for Wood Pellet Scenario

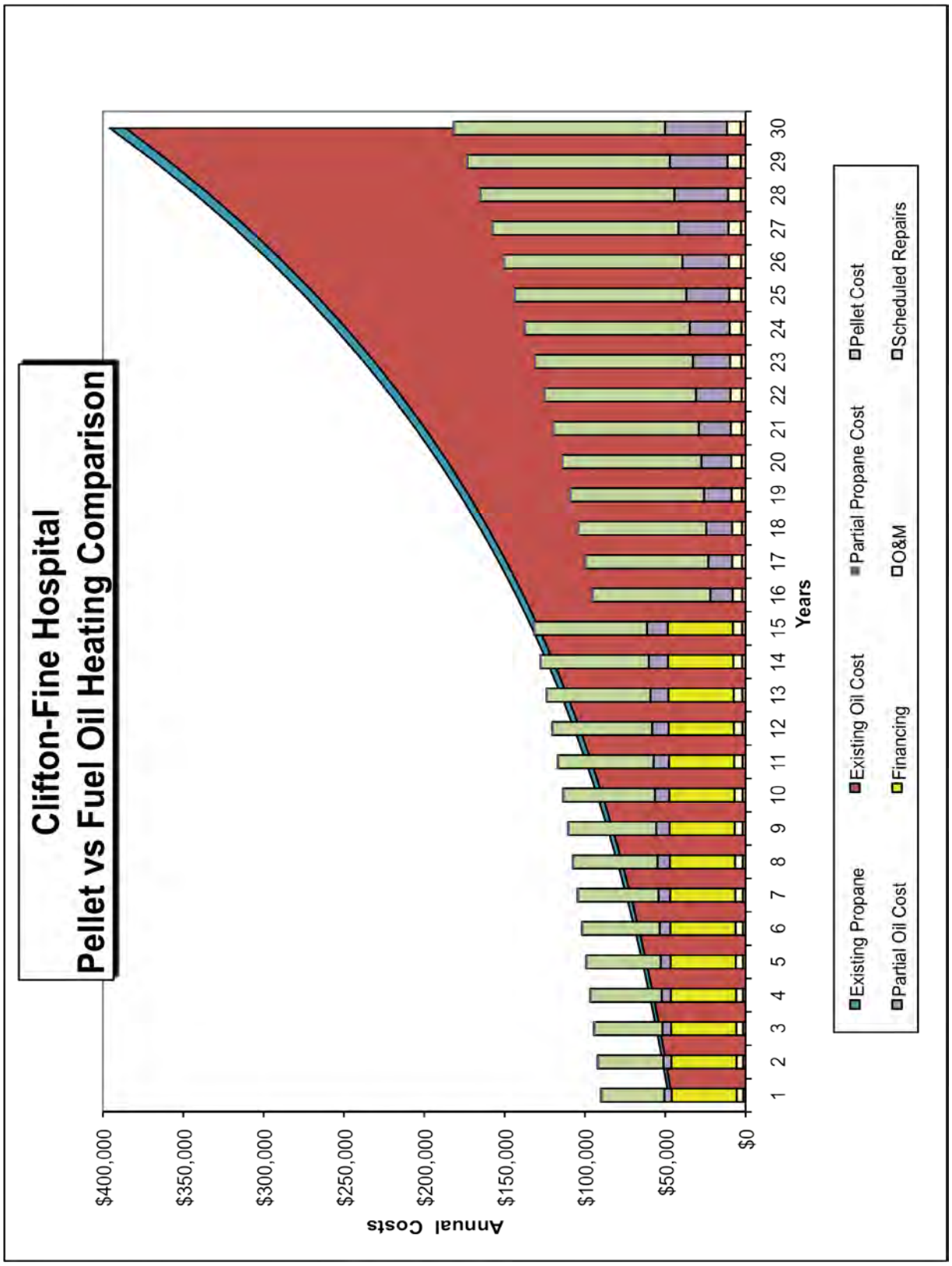


Table 2: 30-Year Life Cycle Analysis Spreadsheet for Wood Pellet Scenario

Clifton-Fine Hospital			Preliminary Life Cycle Cost Estimate			Pellets - Heat Only
Total estimated construction costs	$484,546					
Financing:	3.0%	Assumed interest rate each year, 15 years				
Oil heat consumption	22,500	10% oil =	2,250 gallons	188 tons if 100% pellets for oil		120 gal. / ton of pellets
Oil heat price	$2.05					
Oil heat cost	$46,125					
Propane heat consumption	1,060	10% Propane =	106 gallons	6 tons if 100% pellets for propane		168 gal. / ton of pellets
Propane heat price	$1.81					
Propane heat cost	$1,919					
Estimated pellet utilization	90%					
Projected pellet consumption	175	tons				
Estimated 1st year pellet price	$225	/ ton Year 1				
Projected 1st year pellet cost	$39,286					
Projected 1st year partial fuel oil cost	$4,613					
General Inflation:	2.6%	annually	Twenty year average annual US Labor Dept. Consumer Price Index increases			
Oil Inflation	7.6%		Average increase for New York Residential Fuel Oil from 1991 - 2009 (US EIA)			
Propane Inflation	5.8%		Average increase for New York Residential Propane from 1991 - 2009 (US EIA)			
Pellet Inflation:	4.25%	annually	Estimate from Biomass Energy Resource Center			
O & M.:	$4,000	in Year 1 $	Estimate of additional electricity for feed system motors and additional maintenance staff time			
Major Repairs:	$1,500		Contingency for major repair (e.g. refractory replacement) at Years 10, 20 and 30 annualized			

Yr.	Oil Cost	Propane Cost	Total	Financing	Pellet Cost	Partial Oil Cost	Partial Propane Cost	O&M	Scheduled Repairs	Total	Annual Cashflow	Cumulative Cashflow
1	$46,125	$1,919	$48,044	$40,589	$39,286	$4,613	$192	$4,000	$1,500	$90,179	-$42,135	-$42,135
2	$49,631	$2,030	$51,660	$40,589	$40,955	$4,963	$203	$4,104	$1,539	$92,353	-$40,693	-$82,828
3	$53,402	$2,148	$55,550	$40,589	$42,696	$5,340	$215	$4,211	$1,579	$94,629	-$39,079	-$121,907
4	$57,461	$2,272	$59,733	$40,589	$44,510	$5,746	$227	$4,320	$1,620	$97,013	-$37,280	-$159,187
5	$61,828	$2,404	$64,232	$40,589	$46,402	$6,183	$240	$4,433	$1,662	$99,509	-$35,277	-$194,464
6	$66,527	$2,543	$69,070	$40,589	$48,374	$6,653	$254	$4,548	$1,705	$102,123	-$33,053	-$227,516
7	$71,583	$2,691	$74,274	$40,589	$50,430	$7,158	$269	$4,666	$1,750	$104,862	-$30,588	-$258,105
8	$77,023	$2,847	$79,870	$40,589	$52,573	$7,702	$285	$4,787	$1,795	$107,732	-$27,862	-$285,966
9	$82,877	$3,012	$85,889	$40,589	$54,808	$8,288	$301	$4,912	$1,842	$110,739	-$24,850	-$310,816
10	$89,176	$3,186	$92,362	$40,589	$57,137	$8,918	$319	$5,039	$1,890	$113,891	-$21,529	-$332,346
11	$95,953	$3,371	$99,324	$40,589	$59,565	$9,595	$337	$5,171	$1,939	$117,196	-$17,872	-$350,217
12	$103,246	$3,567	$106,812	$40,589	$62,097	$10,325	$357	$5,305	$1,989	$120,661	-$13,849	-$364,066
13	$111,092	$3,774	$114,866	$40,589	$64,736	$11,109	$377	$5,443	$2,041	$124,295	-$9,430	-$373,496
14	$119,535	$3,992	$123,528	$40,589	$67,487	$11,954	$399	$5,584	$2,094	$128,107	-$4,580	-$378,075
15	$128,620	$4,224	$132,844	$40,589	$70,356	$12,862	$422	$5,730	$2,149	$132,107	$737	-$377,338
16	$138,395	$4,469	$142,864		$73,346	$13,840	$447	$5,879	$2,204	$95,715	$47,149	-$330,190
17	$148,913	$4,728	$153,641		$76,463	$14,891	$473	$6,031	$2,262	$100,120	$53,521	-$276,669
18	$160,230	$5,002	$165,233		$79,713	$16,023	$500	$6,188	$2,321	$104,745	$60,488	-$216,181
19	$172,408	$5,292	$177,700		$83,100	$17,241	$529	$6,349	$2,381	$109,600	$68,100	-$148,081
20	$185,511	$5,599	$191,110		$86,632	$18,551	$560	$6,514	$2,443	$114,700	$76,410	-$71,671
21	$199,610	$5,924	$205,534		$90,314	$19,961	$592	$6,684	$2,506	$120,057	$85,476	$13,806
22	$214,780	$6,267	$221,047		$94,152	$21,478	$627	$6,857	$2,571	$125,686	$95,362	$109,167
23	$231,103	$6,631	$237,734		$98,154	$23,110	$663	$7,036	$2,638	$131,601	$106,133	$215,300
24	$248,667	$7,015	$255,683		$102,325	$24,867	$702	$7,219	$2,707	$137,819	$117,864	$333,164
25	$267,566	$7,422	$274,988		$106,674	$26,757	$742	$7,406	$2,777	$144,356	$130,632	$463,795
26	$287,901	$7,853	$295,753		$111,208	$28,790	$785	$7,599	$2,850	$151,231	$144,522	$608,317
27	$309,781	$8,308	$318,089		$115,934	$30,978	$831	$7,796	$2,924	$158,463	$159,626	$767,944
28	$333,325	$8,790	$342,114		$120,861	$33,332	$879	$7,999	$3,000	$166,071	$176,043	$943,987
29	$358,658	$9,299	$367,957		$125,998	$35,866	$930	$8,207	$3,078	$174,078	$193,879	$1,137,865
30	$385,916	$9,839	$395,754		$131,353	$38,592	$984	$8,420	$3,158	$182,506	$213,248	$1,351,113
Totals	$4,856,843	$146,417	$5,003,260	$608,831	$2,297,640	$485,684	$14,642	$178,436	$66,914	$3,652,147	$1,351,113	
30 Yr. NPV at 3% Discount Rate	$2,716,315	$84,671	$2,800,986	$484,546	$1,370,394	$271,631	$8,467	$110,176	$41,316	$2,286,530	$514,455	

Total Annual Heating Costs	Pellet Fuel /Year	Partial Fuel Oil First Year	Partial Propane First Year	Pellet System O&M /yr	Contingency Allowance / Year	Pellet + Fuel + O&M + Contingency	1st year Fuel Cost Savings	30 Yr. NPV Savings
$48,044	$39,286	$4,613	$192	$4,000	$1,500	$49,590	($1,546)	$514,455

ADDITONAL ISSUES TO CONSIDER

ENERGY MANAGEMENT

In order to effectively manage energy use and to identify efficiency opportunities in buildings it is very important to track energy usage. Unless energy consumption is measured over time, it is difficult or impossible to know the impact of efficiency improvements or renewable energy investments. The Environmental Protection Agency developed a public domain software program called *Portfolio Manager* that can track and assess energy and water consumption across an entire portfolio of buildings. *Portfolio Manager* can help set efficiency priorities, identify under-performing buildings, verify efficiency improvements, and receive EPA recognition for superior energy performance. Yellow Wood recommends that the hospital input several years' worth of energy and water use data into *Portfolio Manager* as soon as it can. The EPA *Portfolio Manager* software can be downloaded at the following address: http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager

ENERGY EFFICIENCY

Whether the hospital converts to biomass or stays with fuel oil, it 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 hospital'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 hospital 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.

To give an idea of the benefits of energy efficiency in hospitals, an Energy Efficiency Case Study for the Othello Community Hospital is also included in the binder.

COMMISSIONING

Commissioning of a new 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. We strongly recommend that Clifton-Fine Hospital work with an independent, third-party, commissioning agent during the design and

construction of a biomass heating system. See the *Biomass and Green Building Resources* binder for more information on commissioning.

ADDING THE MAINTENANCE BUILDING TO THE BIOMASS PROJECT

The analysis in this project assumed connecting the maintenance building heating system to the main hospital building. An allowance for burying insulated pipe and for interconnecting the two systems was included in the analysis. However, developing detailed engineering project costs was not included in the scope of this study. If the hospital moves forward with this project, facility managers should ask the engineering team to carefully consider the costs of adding the maintenance building to the project. If the costs for this piece of the project are estimated to exceed $20,000 then the project would be more cost effective without adding the maintenance building.

PROJECT FUNDING POSSIBILITIES

USDA FUNDING OPPORTUNITIES

2008 Farm Bill

The 2008 Farm Bill has a number of provisions that may help rural communities consider and implement renewable energy and energy efficiency projects. **Section 9009** provides grants for the purpose of enabling rural communities to increase their energy self-sufficiency.

Rural Community Facilities Grant and Loan Program

The USDA provides grants and loans to assist the development of essential community facilities. Grants can be used to construct, enlarge or improve community facilities for health care, public safety and other community and public services. The amount of grant assistance depends on the median household income and the population of the community where the project is located.

These grants and loans are also competitive. Highest priority projects are those that serve small communities, those that serve low-income communities and those that are highly leveraged with other loan and grant awards.

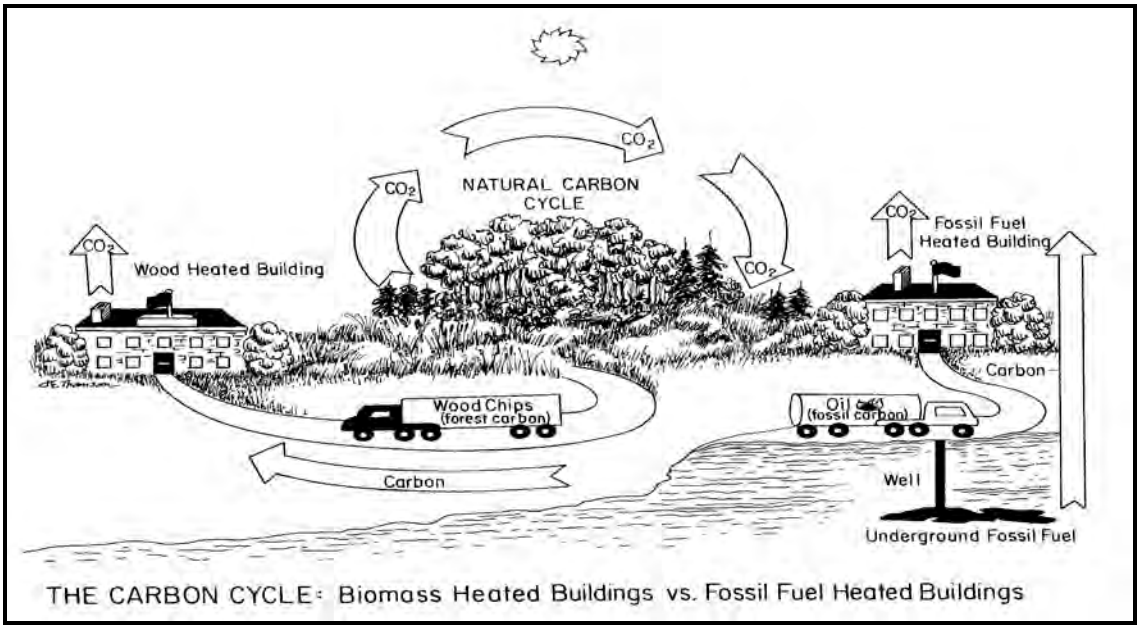
For more information about USDA programs and services, contact your local USDA office. Information on programs and contact information is provided in the *Biomass and Green Building Resources* binder.

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 Clifton-Fine Hospital could undertake that would reduce its carbon footprint more than switching their heating fuel use from fuel oil and propane to a biomass fuel.

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.

Figure 2: Carbon Cycle Illustration[1]



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 22.2 lbs. of CO_2 is produced from each gallon of fuel oil consumed and 12.5 lbs. per gallon of propane. It is projected that the Clifton-Fine Hospital can offset approximately 20,000 gallons of fuel oil and 900 gallons of propane per year by replacing that heat using biomass. This is equivalent to about 225 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 $650 - $1,100 or a lump sum up front payment of as much as $11,000.

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.

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

PERMITTING

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 fuel oil, 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.

Pellet boilers have not had as much emissions testing as woodchip boilers in the United States so there is less concrete data about performance and emissions. However, pellet fuel boilers are much more common in Europe and testing there indicates that pellet boilers have fewer lbs/mBtu of particulate emissions than woodchip boilers.

For the analysis in this report, an allowance for an electrostatic precipitator pollution control device was included in the Capital Cost estimates. If the facility moves forward with this project, the engineering design team should determine exactly what pollution control device would be required for the particular boiler equipment selected.

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 facilities. 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 a 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. Under the proposed EPA new Area Source Rule, a Bag House/ESP would be required.

EPA continues to review comments on the proposal. Details and updates will be posted at www.epa.gov/airquality/combustion/

CONCLUSIONS AND RECOMMENDATIONS

The analysis provided in this report indicates that Clifton-Fine Hospital could save over $500,000 in operating costs over 30 years in today's dollars even when the cost of financing is included. However, all of these savings are achieved in the later half of the 30-year analysis period and annual operating costs would actually rise in the early years.

Yellow Wood recommends taking the following steps to investigate this opportunity further:

1. While the fuel cost savings for this project are reasonable over time, several things could make this project more financially attractive.
    a. The Clifton-Fine Central School is also considering a pellet boiler installation. Hospital and school facility managers should consider negotiating bulk purchasing of pellet fuel together in order to get a better price.
    b. If the hospital were to find grants that helped offset project costs or lower interest loans to finance the project, then obviously the economics of the project could improve. There is a section in the report that highlights several potential funding sources.
2. If the hospital wants to move forward with a project they will need to hire an engineering firm to help refine the project concept and to obtain firm local estimates on project costs. It is possible that a local engineering firm might be able to find installation cost savings that could make this project more financially attractive. The US Forest Service may be able to provide some engineering technical assistance from an engineering team with biomass experience that is part of the program that funded this study. If the facility moves forward with this project, they should contact Lew McCreery, the US Forest Service Biomass Coordinator for the Northeastern Area to see what assistance can be provided. His contact information is: 304-285-1538, lmccreery@fs.fed.us.
3. The engineering team should investigate whether or not it truly would be cost effective to add the maintenance building to the central heating system in the main hospital building. If this can be done for less than $20,000, then the net present value savings for the project will improve.
4. The hospital should identify any heating system improvements it plans to undertake and consider including those projects with the biomass project. It will be more cost effective to implement boiler room upgrades and heating distribution improvements concurrent with the installation of a new boiler system than it would be to postpone those improvements for a later time.
5. Costs for an electrostatic precipitator pollution control device were included in the analysis for this report. If the facility moves forward with this project, the engineering design team should determine exactly what pollution control equipment would be required for the particular boiler equipment selected.

6. The New York State Energy Research and Development Authority (NYSERDA) and/or the New York Power Authority (NYPA) should be engaged to develop comprehensive energy efficiency recommendations and proposals for incentives for efficiency upgrades before undertaking a major building project. This should be done regardless of whether or not the hospital moves ahead with a biomass project at this time. Information on energy efficiency programs is included in the *Biomass and Green Building Resources* binder accompanying this report.

7. In order to effectively measure progress toward energy efficiency goals historical energy consumption data should be collected and updated frequently. There are many tools to help the hospital accomplish this. One such tool is the EPA Energy Star *Portfolio Manager* software. It is free public domain software that helps facility managers track energy and water use. This software can be downloaded at:
   http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager

8. Concurrent with the design of a biomass project, the hospital should investigate potential wood pellet fuel providers. The New York State Forest Utilization Program maintains an up-to-date list of biomass fuel suppliers. Their contact information is included in the appendices at the end of 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, LLC

Richmond Energy Associates, LLC 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

WOOD PELLET FUEL

Wood pellets are made from wood waste materials that are compressed into pellets under heat and pressure. Natural plant lignin holds the pellets together without glues or additives. Wood pellets are of uniform size, shape and composition making them easy to store and to burn.

Much of the pellet fuel market is geared toward supplying 40 pound bags for residential scale pellet stoves and boilers. Commercial scale systems typically have bulk storage of pellet fuel that can then be fed into the boiler automatically. Therefore pellet fuel suppliers for a commercial scale system need to have the ability to deliver in self unloading trucks. Commercial scale pellet consumers should identify several pellet fuel manufacturers within a 200 mile radius that have the capability to deliver pellet fuel in bulk.

Figure 3: Typical Bulk Pellet Fuel Storage and Delivery[2]

It is best to secure a supplier that will guarantee supply for at least a complete heating season. Distance from the manufacturer will affect cost so generally the closer the supplier, the better the delivered price.

[2] Photo taken from the *Wood Pellet Heating Guidebook* published by Massachusetts Division of Energy Resources.

POTENTIAL BIOMASS FUEL SUPPLIERS

The number of pellet manufactuers in the region is increasing. For the most up-to-date information on potential providers contact the New York State Forest Utilization Program:

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