



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



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 AND  
 RESOURCE CENTER**

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# Preliminary Feasibility Report

## Biomass Heating Analysis for Clifton-Fine Central School

Star Lake, New York

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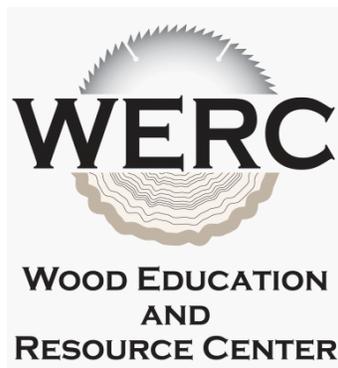


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**Clifton-Fine Central**  
 HOME OF THE EAGLES





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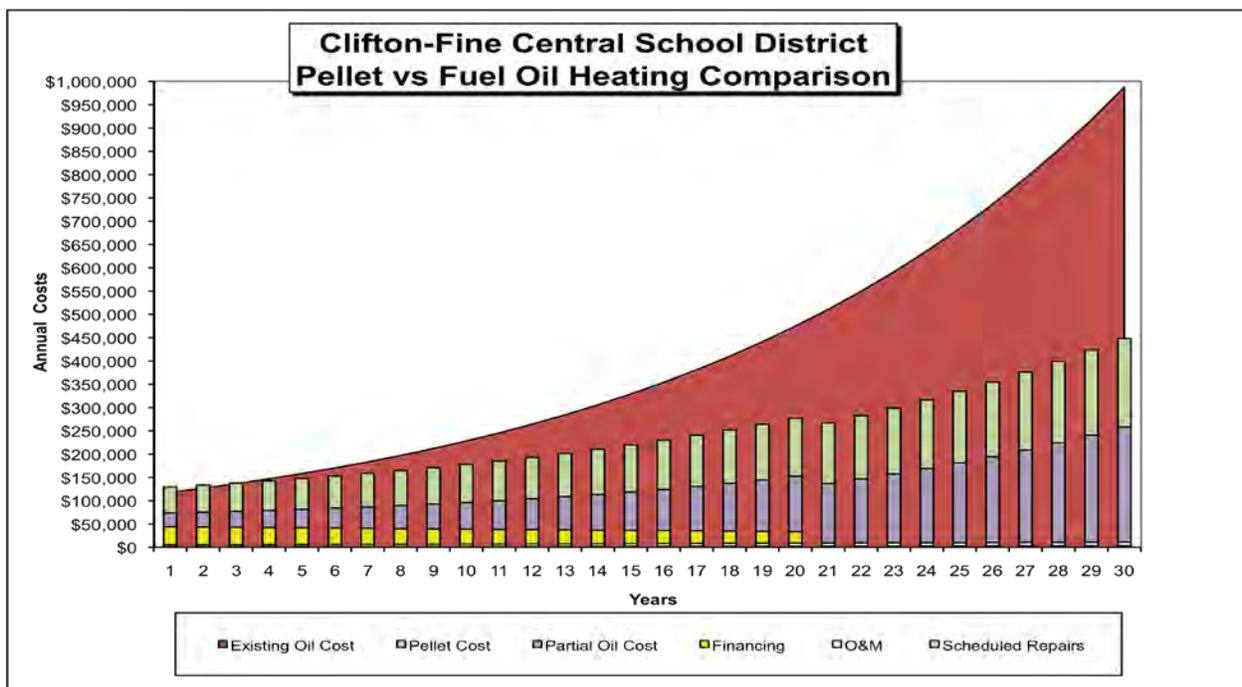
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## EXECUTIVE SUMMARY

Clifton-Fine Central School is a K-12 school located in Star Lake, New York. The school has approximately 113,000 square feet of building space which is heated by two 5.0 mmBtu hot water boilers located in a central boiler plant. Both boilers use #2 fuel oil. Maintenance staff report that either boiler will carry the entire heat load of the building. These boilers are approximately 10 years old and appear to have been well maintained and in good working condition. Because the boilers were refurbished in 2000, that upgrade is not yet fully depreciated by state education department standards and no state aid was factored into the analysis for this report.

The district currently uses over 39,000 gallons of fuel oil on average each year. At the two-year average price of \$2.97 per gallon the school will spend more than \$118,000 on fuel costs this coming year.



The Clifton-Fine Central School received a pre-feasibility study for a fully-automated woodchip biomass system in 2008 from the New York Department of Environmental Conservation. The school continues to be interested in biomass heat and this analysis evaluates a wood pellet system for the school.

The analysis provided in this report indicates that Clifton-Fine Central School could save over \$2.6 million in operating costs over 30 years in today's dollars even when the cost of financing is included. The analysis shows more than \$27,000 in fuel savings in the first year alone.

The wood pellet biomass scenario evaluated for this report appears cost effective and Yellow Wood recommends moving forward with a project.

We recommend the district take the following steps to investigate this opportunity further:

1. The district 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.
2. The district should hire an engineering firm to help refine the project concept and to obtain firm local estimates on project costs. 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](mailto:lmccreery@fs.fed.us).
3. Emission regulations for commercial boilers will be changing in the near future. The EPA is undergoing a public review process for draft rules that could affect the type of equipment specified for a site like this. The engineers hired by the district for a biomass project should carefully review the new rules and evaluate the best available technology options for pollution control devices when they are designing this project.
4. Regardless of whether Clifton-Fine Central School moves forward with a biomass energy system, the district should consider energy efficiency improvements. The efficiency of the building envelope and ventilation equipment needs to be considered when sizing new boiler equipment. 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 district 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.
5. 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 school 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](http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager).
6. Concurrent with the design of a biomass project, Clifton-Fine Central School 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 Central School. 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 Central School 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 school. 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.

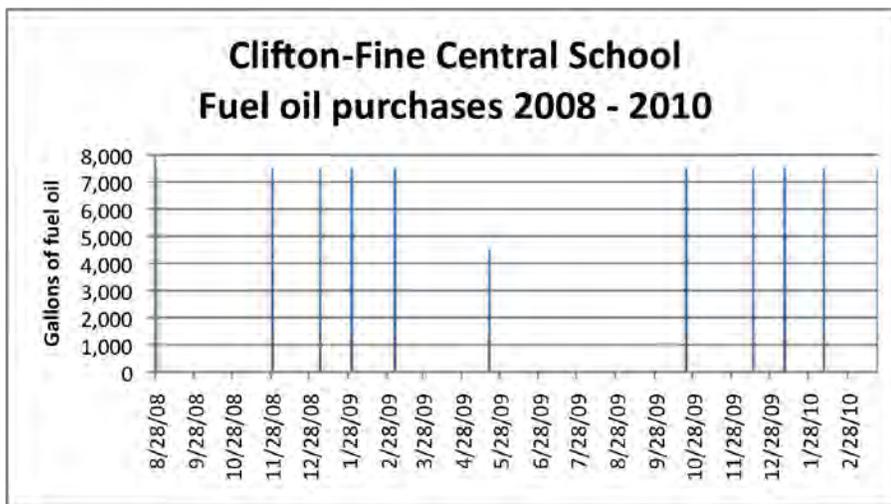
This preliminary feasibility study was prepared by Yellow Wood Associates and Richmond Energy Associates, LLC.

# ANALYSIS ASSUMPTIONS

## DESCRIPTION OF THE EXISTING HEATING SYSTEM

Clifton-Fine Central School is a K-12 school located in Star Lake, NY. The district serves approximately 350 students in one 113,000 square foot building. The school is heated by a central boiler plant that includes two 5.0 mmBtu Cleaver Brooks hot water boilers that use #2 fuel oil.

**Figure 1: Fuel Usage**



Maintenance staff report that either boiler will carry the entire heat load of the building and therefore the school currently has 100% redundant boiler capacity. The boilers were purchased in 2000 and both appear to have been well maintained and are in good working condition. Over the past two years, the school used an average of nearly 39,745 gallons of fuel oil to heat the building annually.

## 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 school's existing heating system. There appears to be plenty of room in the existing boiler room to accommodate another boiler of this size. Included in the proposed capital costs are costs for a separate stack for the pellet boiler, costs for a thirty-ton silo to store wood pellet fuel, an allowance for a pollution control device and an allowance for interconnecting with the existing heating distribution system.

## 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 Central School. The scenario includes all ancillary equipment and interconnection costs. Under the biomass scenario, the existing heating equipment 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 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, the district should 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 the Clifton-Fine Central School indicate that Clifton-Fine uses an average of 39,745 gallons of fuel oil per year to heat the school building being considered in this analysis. This is the assumed annual fuel consumption used for the base case in the analysis. Over the past two years, the district paid an average of \$2.97 per gallon for fuel oil. At that price, Clifton-Fine will spend more than \$118,000 for fuel oil to heat this building 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 woodchip prices. However, pellets are still a relatively local product so they won't likely have the same geopolitical pressures as fossil fuels. After consulting with the NY Department of Environmental Conservation Forests and Lands staff, 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.

The pellet scenario assumes the facility will meet 75% of its winter heating needs with pellets and therefore consume 249 tons of pellets per year at \$225 per ton in the first year. The remaining 25% of the heating needs were then assumed to be provided by #2 fuel oil, consuming about 9,936 gallons of fuel oil per year. The costs for supplemental fuel oil 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. Clifton-Fine's fuel rate of \$2.97/gallon was used for the first year of the analysis and then inflated each year at 7.6%.

Pellet fuel pricing tends to track that of fossil fuels 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 rate of inflation over the same period 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 an 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 fuel oil boilers were taken into consideration as these are considered costs that Clifton-Fine Central School would have paid anyway. It was assumed that all costs for the operation and maintenance of a biomass boiler are incremental additional costs.

## **STATE SCHOOL CONSTRUCTION AID**

Biomass boilers are eligible for New York State school construction aid. However, the New York Facilities Planning Division for the State Department of Education (SED) does not like to fund new boilers until the existing boilers are fully depreciated. SED generally considers boilers fully depreciated after fifteen years although they do recognize that boilers can last a good deal longer. Since Clifton-Fine Central School upgraded its boilers in 2000, they may not be eligible for state school construction aid for a biomass boiler at this time. However, the savings for this project may be compelling enough that district decision makers may feel the project is worthwhile even without state school construction aid. In

any event, the district should consult state officials about any planned construction project and get their determination on state aid directly from SED.

For the analysis in this report, it was assumed that this project would receive no state school construction aid and that the local district would finance the entire project.

## **FINANCING ASSUMPTIONS**

Financing costs were included in the analysis to give district decision makers a sense of how this project may impact their annual budget. Public schools typically have access to long-term, low interest bond financing. It was assumed that the Clifton-Fine Central School District would be able to obtain a 20-year bond for the capital costs for the biomass project at an interest rate of 3%. The bond payment schedule that was used has fixed principal payments and variable interest payments. 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 district were to forego financing and pay for the project outright, the overall savings would be considerably greater.

## BIOMASS SCENARIO ANALYSIS

The analysis shows that Clifton-Fine could save more than \$2.6 million in today's dollars in operating costs over the next 30 years by installing a wood pellet heating system, even including debt service on the cost of the system. Annual fuel savings alone are projected to be approximately \$27,000 per year in the first year and should increase over time as fuel oil prices continue to climb. If fuel prices increase as projected, the project will have a positive annual cash flow within a few years.

**Table 1: Wood Pellet Scenario Analysis Assumptions**

<b>Clifton-Fine Central School</b>	
<b>Capital Cost Assumptions</b>	
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
<b>Total estimated project costs</b>	<b>\$484,546</b>
<b>State Aid</b>	<b>\$0</b>
<b>Total Local Share</b>	<b>\$484,546</b>
<b>Financing Costs</b>	
Financing, annual interest rate	3.0%
Finance term (years)	20
1st full year debt service	\$38,764
<b>Fuel Cost Assumptions</b>	
Current annual fuel oil consumption in gallons	39,745
Assumed fuel oil price per gallon	\$2.97
Projected annual fuel oil bill	\$118,043
Assumed pellet price in 1st year (per ton)	\$225
Projected 1st year pellet fuel bill	\$55,945
Projected 1 <sup>st</sup> year supplemental fuel oil bill	\$29,511
<b>Inflation Assumptions</b>	
General inflation rate (twenty year average CPI)	2.6%
Fuel oil inflation rate (twenty year EIA average for New York)	7.6%
Pellet inflation rate (estimate from Biomass Energy Resource Center)	4.25%
<b>O&amp;M Assumptions</b>	
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
<b>Savings</b>	
Net 1 <sup>st</sup> year fuel savings	\$27,087
<b>Total 30 year NPV cumulative savings</b>	<b>\$2,626,101</b>

Figure 2: Annual Cash Flow Graph for Wood Pellet Scenario

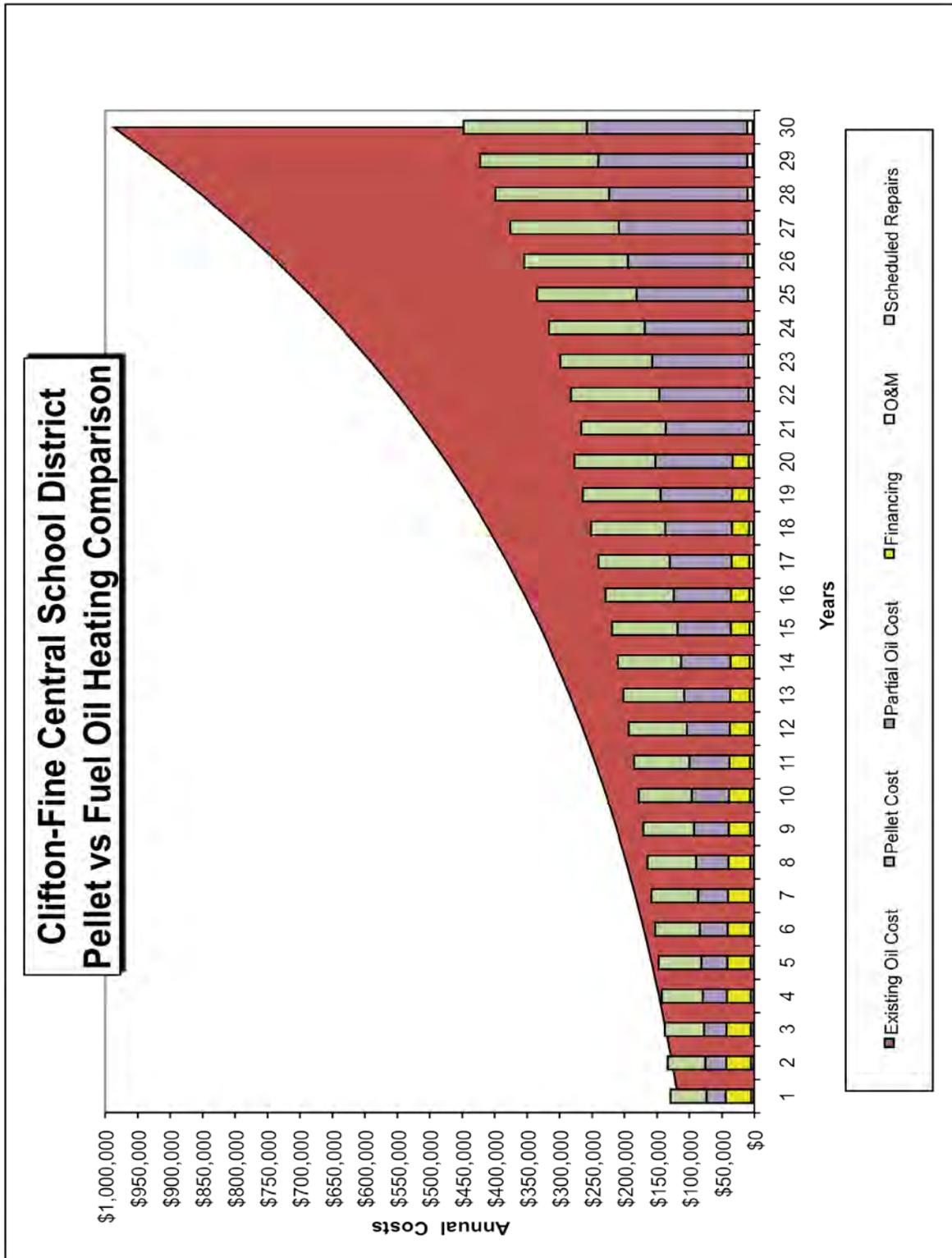


Table 2: 30-Year Life Cycle Analysis Spreadsheet for Wood Pellet Scenario

Clifton-Fine Central School										Pellets - Heat Only									
Total estimated construction costs					Estimated state aid					332 tons if 100% pellets for oil					120 gal. / ton of pellets				
Local Share:					\$0					3.0% Assumed interest rate each year, 20 years					25% oil =				
Financing:					39,745					9,936 gallons									
Oil heat consumption					\$2.97														
Oil heat price					\$118,043														
Oil heat cost					75%														
Estimated pellet utilization					249 tons														
Projected pellet consumption					\$225 / ton Year 1														
Estimated 1st year pellet price					\$55,945														
Projected 1st year pellet cost					\$29,511														
Projected 1st year partial fuel oil cost					7.6% annually														
General Inflation:					4.25% annually														
Oil Inflation:					\$4,000 in Year 1 \$														
Pellet Inflation:					\$1,500														
O & M:																			
Major Repairs:																			
<p>Twenty year average annual US Labor Dept. Consumer Price Index increases</p> <p>Average increase for New York Residential Fuel Oil from 1991 - 2009 (US EIA)</p> <p>Estimate from Biomass Energy Resource Center</p> <p>Estimate of additional electricity for feed system motors and additional maintenance staff time</p> <p>Contingency for major repair (e.g. refractory replacement) at Years 10, 20 and 30 annualized</p>																			
Yr.	Oil Cost	Total	Financing	Pellet Cost	Partial Oil Cost	O&M	Scheduled Repairs	Total	Annual Cashflow	Cumulative Cashflow									
1	\$118,043	\$118,043	\$38,764	\$55,945	\$29,511	\$4,000	\$1,500	\$129,720	-\$11,677	-\$11,677									
2	\$127,014	\$127,014	\$38,037	\$58,323	\$31,753	\$4,104	\$1,539	\$133,756	-\$6,743	-\$18,420									
3	\$136,667	\$136,667	\$37,310	\$60,802	\$34,167	\$4,211	\$1,579	\$138,058	-\$1,401	-\$19,821									
4	\$147,054	\$147,054	\$36,583	\$63,386	\$36,763	\$4,320	\$1,620	\$142,673	\$4,381	-\$15,440									
5	\$158,230	\$158,230	\$35,856	\$66,080	\$39,557	\$4,433	\$1,662	\$147,588	\$10,641	-\$4,799									
6	\$170,255	\$170,255	\$35,130	\$68,888	\$42,564	\$4,548	\$1,705	\$152,835	\$17,420	\$12,622									
7	\$183,195	\$183,195	\$34,403	\$71,816	\$45,799	\$4,666	\$1,750	\$158,433	\$24,761	\$37,383									
8	\$197,117	\$197,117	\$33,676	\$74,868	\$49,279	\$4,787	\$1,795	\$164,406	\$32,711	\$70,094									
9	\$212,098	\$212,098	\$32,949	\$78,050	\$53,025	\$4,912	\$1,842	\$170,777	\$41,321	\$111,415									
10	\$228,218	\$228,218	\$32,222	\$81,367	\$57,054	\$5,039	\$1,890	\$177,573	\$50,645	\$162,060									
11	\$245,562	\$245,562	\$31,495	\$84,825	\$61,391	\$5,171	\$1,939	\$184,821	\$60,741	\$222,801									
12	\$264,225	\$264,225	\$30,769	\$88,430	\$66,056	\$5,305	\$1,989	\$192,550	\$71,675	\$294,477									
13	\$284,306	\$284,306	\$30,042	\$92,189	\$71,077	\$5,443	\$2,041	\$200,791	\$83,515	\$377,992									
14	\$305,913	\$305,913	\$29,315	\$96,107	\$76,478	\$5,584	\$2,094	\$209,579	\$96,335	\$474,326									
15	\$329,163	\$329,163	\$28,588	\$100,191	\$82,291	\$5,730	\$2,149	\$218,948	\$110,214	\$584,541									
16	\$354,179	\$354,179	\$27,861	\$104,449	\$88,545	\$5,879	\$2,204	\$228,939	\$125,241	\$709,782									
17	\$381,097	\$381,097	\$27,135	\$108,888	\$95,274	\$6,031	\$2,262	\$239,590	\$141,506	\$851,288									
18	\$410,060	\$410,060	\$26,408	\$113,516	\$102,515	\$6,188	\$2,321	\$250,948	\$159,112	\$1,010,400									
19	\$441,225	\$441,225	\$25,681	\$118,341	\$110,306	\$6,349	\$2,381	\$263,058	\$178,167	\$1,188,567									
20	\$474,758	\$474,758	\$24,954	\$123,370	\$118,689	\$6,514	\$2,443	\$275,971	\$198,787	\$1,387,354									
21	\$510,839	\$510,839	\$24,227	\$128,613	\$127,710	\$6,684	\$2,506	\$289,524	\$245,326	\$1,632,681									
22	\$549,663	\$549,663	\$23,500	\$134,079	\$137,416	\$6,857	\$2,571	\$303,624	\$268,739	\$1,901,420									
23	\$591,438	\$591,438	\$22,773	\$139,778	\$147,859	\$7,036	\$2,638	\$318,311	\$294,126	\$2,195,546									
24	\$636,387	\$636,387	\$22,046	\$145,718	\$159,097	\$7,219	\$2,707	\$333,441	\$321,646	\$2,517,193									
25	\$684,752	\$684,752	\$21,319	\$151,911	\$171,188	\$7,406	\$2,777	\$349,163	\$351,469	\$2,868,662									
26	\$736,793	\$736,793	\$20,592	\$158,368	\$184,198	\$7,599	\$2,850	\$365,414	\$383,779	\$3,252,441									
27	\$792,790	\$792,790	\$19,865	\$165,098	\$198,197	\$7,796	\$2,924	\$374,016	\$418,774	\$3,671,215									
28	\$853,042	\$853,042	\$19,138	\$172,115	\$213,260	\$7,999	\$3,000	\$396,374	\$456,668	\$4,127,883									
29	\$917,873	\$917,873	\$18,411	\$179,430	\$229,468	\$8,207	\$3,078	\$420,163	\$497,690	\$4,625,573									
30	\$987,631	\$987,631	\$17,684	\$187,056	\$246,908	\$8,420	\$3,158	\$445,541	\$542,090	\$5,167,662									
Totals	\$12,429,586	\$12,429,586	\$637,177	\$3,272,000	\$3,107,397	\$178,436	\$665,914	\$682,527	\$11,547,050										
30 Yr. NPV at 3% Discount Rate																			
Total Annual Heating Costs					Total Annual Heating Costs					Total Annual Heating Costs					Total Annual Heating Costs				
\$118,043					\$118,043					\$118,043					\$118,043				
Pellet Fuel /Year					Pellet Fuel /Year					Pellet Fuel /Year					Pellet Fuel /Year				
\$55,945					\$55,945					\$55,945					\$55,945				
Partial Fuel Oil First Year					Partial Fuel Oil First Year					Partial Fuel Oil First Year					Partial Fuel Oil First Year				
\$29,511					\$29,511					\$29,511					\$29,511				
System O&M /yr					System O&M /yr					System O&M /yr					System O&M /yr				
\$4,000					\$4,000					\$4,000					\$4,000				
Pellet System O&M /yr					Pellet System O&M /yr					Pellet System O&M /yr					Pellet System O&M /yr				
\$1,951,536					\$1,951,536					\$1,951,536					\$1,951,536				
Contingency Allowance / Year					Contingency Allowance / Year					Contingency Allowance / Year					Contingency Allowance / Year				
\$1,500					\$1,500					\$1,500					\$1,500				
Fuel + O&M + Contingency					Fuel + O&M + Contingency					Fuel + O&M + Contingency					Fuel + O&M + Contingency				
\$90,956					\$90,956					\$90,956					\$90,956				
Annual Fuel Cost Savings					Annual Fuel Cost Savings					Annual Fuel Cost Savings					Annual Fuel Cost Savings				
\$27,087					\$27,087					\$27,087					\$27,087				
Local Share Cost					Local Share Cost					Local Share Cost					Local Share Cost				
\$484,546					\$484,546					\$484,546					\$484,546				
Simple Payback (yrs)					Simple Payback (yrs)					Simple Payback (yrs)					Simple Payback (yrs)				
17.9					17.9					17.9					17.9				
30 Yr. NPV Savings					30 Yr. NPV Savings					30 Yr. NPV Savings					30 Yr. NPV Savings				
\$2,626,101					\$2,626,101					\$2,626,101					\$2,626,101				

## ADDITIONAL 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. Richmond Energy recommends that the school 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](http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager).

### ENERGY EFFICIENCY

Whether Clifton-Fine converts to biomass or stays with fuel oil, the school 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 school'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 school 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 schools, an Energy Efficiency Case Study for the U-32 Junior/Senior High School 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 recommend that Clifton-Fine Central School 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.

## PELLETS AS COMPARED TO WOODCHIPS

Clifton-Fine Central School recently had a woodchip feasibility study done as part of a project supported by the New York Department of Environmental Conservation. That study showed larger overall savings for a woodchip boiler system than the savings projected in this study for a pellet boiler system. A woodchip boiler system would also cost substantially more to build.

In general, pellet fuel is more expensive than woodchip fuel, costing about twice as much on a cost per Btu basis. However, pellet boiler equipment and the infrastructure required for the equipment and storage of pellet fuel are far less expensive than what is needed for woodchips.

One significant advantage of a pellet boiler in this application over a woodchip boiler is that a pellet boiler could easily fit within the existing boiler room. By eliminating the costs for a biomass boiler house, the pellet system compares favorably to a woodchip heating system.

The analysis in this report is based on the school being able to get pellet fuel delivered for \$225/ton. The school should confirm this cost before moving ahead with a project. There are now several pellet manufacturing plants within driving distance, which might consider selling pellet fuel in bulk to Clifton-Fine. We recommend approaching several pellet fuel suppliers to get delivery quotes before proceeding with design. If the quoted price is above \$240/ton, another analysis should be completed before the school decides to move forward with a wood pellet system.

# 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.
- ❖ **Section 9013** provides grants to state and local governments to acquire wood energy systems.

These grants and loan guarantee programs are competitive. The school should check with their local USDA office to express interest and to get program roll-out updates.

### 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.

## QUALIFIED SCHOOL CONSTRUCTION BOND

Qualified School Construction Bonds are awarded through the American Recovery and Reinvestment Act. These no-interest loans can be used for taxpayer approved projects to improve school facilities. The Qualified School Construction Bond program absorbs costs that would otherwise be incurred by school districts which have issued voter-approved bonds for construction projects, effectively allowing districts to borrow funds without paying interest. Bondholders are provided with federal tax credits in lieu of the interest that would ordinarily be paid by the school districts which issue them. Through the

program, bondholders receive full return on their investment while school districts are able to finance school construction projects less expensively and jobs are created in local communities.

For more information on Qualified School Construction Bonds, contact:

Carl Thurnau

[cthurnau@mail.nysed.gov](mailto:cthurnau@mail.nysed.gov)

(518) 474-3906

## MUNICIPAL LEASE / PURCHASE

As a municipal entity, Clifton-Fine Central School may be eligible for a municipal lease/purchase arrangement to finance the anticipated project costs for a biomass heating system. A municipal lease is a contract that has many of the characteristics of a standard commercial lease, with at least two primary differences:

- In a municipal lease, the intent of the lessee is to purchase and take title to the equipment. The financing is a full payout contract with no significant residual or balloon payments at the end of the lease term.
- The lease payments include the return of principal and interest, with the interest being exempt from federal income taxation to the recipient. Because the interest is exempt from federal tax, a tax-exempt lease offers the lessee a significant cost savings when compared to conventional leasing.

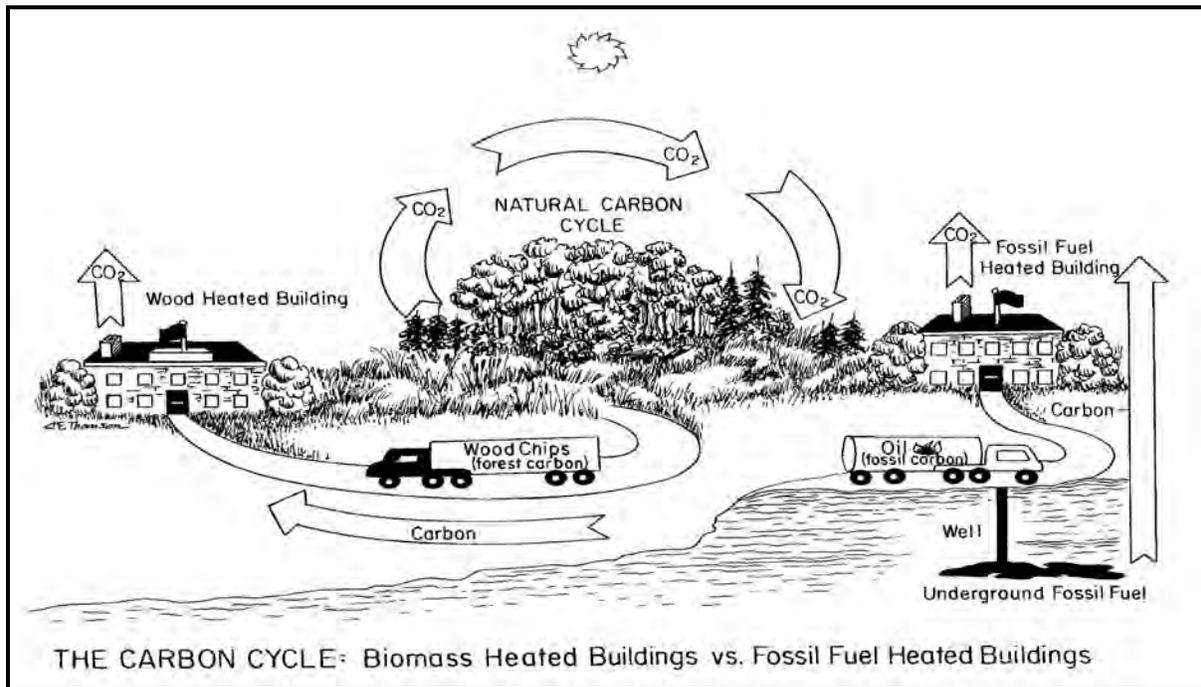
Information about municipal leasing is included in the *Biomass and Green Building Resources* binder accompanying this report.

## 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 Central School could undertake that would reduce its carbon footprint more than switching their heating fuel use from fuel oil 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<sub>2</sub> pollution they create.

Figure 3: Carbon Cycle Illustration<sup>1</sup>



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<sub>2</sub> avoidance is based on the emissions profile (Lbs. CO<sub>2</sub> /Btu) of the displaced fuel. The US EPA calculates that 22.2 lbs. of CO<sub>2</sub> is produced from each gallon of fuel oil consumed. It is projected that the Clifton-Fine Central School can offset approximately 30,000 gallons of fuel oil per year by replacing that heat using biomass. This is equivalent to about 333 tons of CO<sub>2</sub>. 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 \$1,000 - \$1,650 or a lump sum up front payment of as much as \$16,500.

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.

<sup>1</sup> 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<sub>10</sub>). 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.

EPA continues to review comments on the proposal. Details and updates will be posted at [www.epa.gov/airquality/combustion/](http://www.epa.gov/airquality/combustion/).

## CONCLUSIONS AND RECOMMENDATIONS

The wood pellet biomass scenario evaluated for this report appears cost effective and Yellow Wood recommends moving forward with a project. We recommend Clifton-Fine take the following steps to investigate this opportunity further:

1. The district 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.
2. The district should hire an engineering firm to help refine the project concept and to obtain firm local estimates on project costs. 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](mailto:lmccreery@fs.fed.us).
3. Emission regulations for commercial boilers will be changing in the near future. The EPA is undergoing a public review process for draft rules that could affect the type of equipment specified for a site like this. The engineers hired by the district for a biomass project should carefully review the new rules and evaluate the best available technology options for pollution control devices when they are designing this project.
4. Regardless of whether Clifton-Fine Central School moves forward with a biomass energy system, the district should consider energy efficiency improvements. The efficiency of the building envelope and ventilation equipment needs to be considered when sizing new boiler equipment. 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 district 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.
5. 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 school 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](http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager).
6. Concurrent with the design of a biomass project, Clifton-Fine Central School 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 4: Typical Bulk Pellet Fuel Storage and Delivery<sup>2</sup>**



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.

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<sup>2</sup> Photo taken from the *Wood Pellet Heating Guidebook* published by Massachusetts Division of Energy Resources.

## POTENTIAL BIOMASS FUEL SUPPLIERS

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

Sloane Crawford  
Program Leader  
NYS Forest Utilization Program  
625 Broadway  
Albany, NY 12233-4253  
Phone: (518) 402-9415  
Fax: (518) 402-9028  
[sn Crawford@gw.dec.state.ny.us](mailto:sn Crawford@gw.dec.state.ny.us)