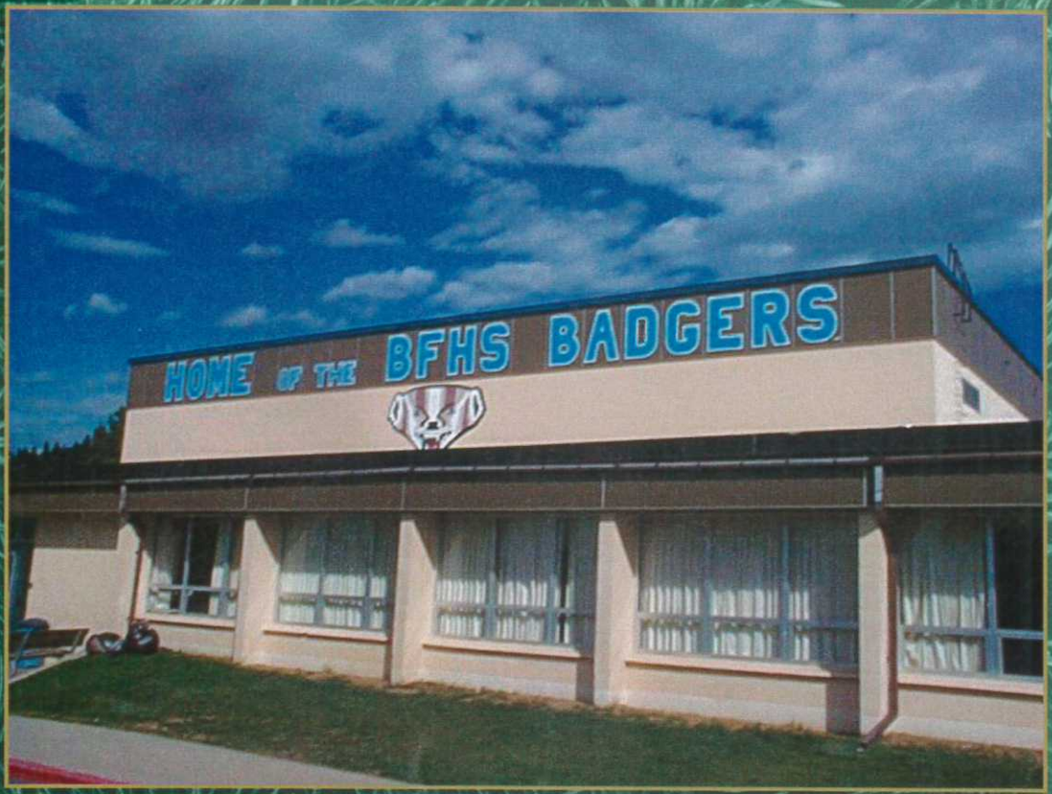
BIOMASS HEATING PRELIMINARY ASSESSMENT

for

Bonners Ferry High School

Bonners Ferry, Idaho

August 6, 2003



CTA
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JOB NAME: BVBM - PRE

Preliminary Assessment for Integration of Biomass Energy Systems

at

Bonners Ferry High School, Bonners Ferry, Idaho

August 8, 2003

Presented by

CTA Architects Engineers
Dan Stevenson

For

United Stated Department of Agriculture
Forest Service
Region One

In partnership with:

Bonners Ferry School District
Idaho Department of Lands

CTA Project: FSBIOMAS-PBA, Bonners Ferry

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Executive Summary

The following assessment was commissioned to determine the technical and economic feasibility of integrating a biomass heating system with the existing facility at Bonners Ferry High School, Bonners Ferry, Idaho. This assessment is funded through the USDA Forest Service, Region One, as part of the Fuels for Schools program. Primary objectives of this program are to:

1. Develop fuel markets for non-merchantable wood residue resulting from fuel reduction treatment on federal, state, and private forestland.

2. Partner with communities, and their school systems, to integrate benefits of fuel reduction treatment into the community. Benefits of sustainable biomass heating systems to communities include:

    a. Stable long term fuel costs;
    b. Low fuel costs compared to other conventional fuels;
    c. Locally produced fuel infuses capital back into the community;
    d. An integrated approach with fuel reduction treatment of forest land results in reduced slash pile disposal fires, improving air quality while heating the school facility and reducing slash fire hazards;
    e. Sustainable biomass is a renewable energy resource;
    f. Sustainable biomass is near zero net carbon emission.

3. Develop practical, cost effective, application models for biomass heating systems into systems representative of a larger application group (schools and commercial buildings).

4. Identify, evaluate, and assist in developing biomass heating projects in schools throughout Region One. This study is among the first in the effort to identify and evaluate potential projects.

The existing School facility includes the High School (55,175 square feet on one level). Based on field investigation and impending remodel, a modular 3 MMBTUH heating hot water plant located southeast of the Metal/ Wood Shop (see Site Plan) was evaluated for implementation. This system provides a heating plant for the High School facility and assumes that the renovation of the High School will convert its heating system to hot water.

A concept and budget estimate was developed for a central boiler plant to serve the High School. The fuel investigated were wood chips derived from forest residue and commercially available hog fuel at 50% moisture content.

Results of Evaluation

The results of this analysis are summarized in the Economic Analysis Summary table below. A detailed report of the results is provided in the Cash Flow Analysis Appendix.

One important variable in this analysis is the cost of biomass fuel. The pricing for wood chips in this analysis is based on conversations with providers, specifically Sam Fodge.

As indicated in the Economic Summary chart below, the evaluated option achieves a positive accumulated cashflow (PAC) in about 16 years. Accumulated cash flow is the

primary evaluation measure that is implemented in this report and is similar to simple payback with the exception that accumulated cash flow takes the cost of financing and fuel escalation into account. For many school districts and municipalities, a positive accumulated cash flow of about 10 years maximum is considered for implementation. Based on this standard, the amount of project subsidy required to achieve a 10-year PAC was calculated and is indicated below.

The approach in analyzing these options has been to remain conservative, yet realistic about the performance of biomass heating plants and the cost of their installation. Due to the preliminary nature of this assessment, it is possible that the construction cost estimates can be reduced as additional information relative to the construction is gathered, favorably affecting the economic analysis.

Economics Summary Chart

Bonners Ferry Biomass Assessment Economic Analysis Summary				
Option Title	***Initial Cost***	***Year Positive Cashflow Occurs at 4.5% APR***	***Year One Energy Savings***	***Project Subsidy Required for 10 year Payback***
Bonners Ferry High School	$440,832	16	$24,636	$141,066

Purpose of Assessment

The intent of this assessment is to provide an initial evaluation tool for a potential biomass heating project. Major components of this assessment include:

- Identification of the peak instantaneous and annual consumption heating demand of existing and proposed facility. (See Heat Load Calculation Summary)
- Development and description of Biomass Boiler System. (See Biomass System Description)
- Identification of technical details related to the integration of a Biomass Boiler system with the existing and proposed facility. (See Evaluation of the Biomass Boiler System / System Integration Summary)
- Estimate Preliminary Project Budget for the Biomass Boiler System. (See Cashflow Analysis and Budget Estimates Appendix)
- Estimate Energy Savings corresponding to the use of Biomass Energy. (See Heat Energy Summary Table)
- Identification of Operating and Maintenance considerations. (See Operations and Maintenance Summary)
- Consolidation of the above information into Project Economic Analysis for the Biomass Boiler System. (See Evaluation Procedure)
- Summary of potential project financing. (See Evaluation of the Biomass Boiler System/ Financing Options and Financing Portion)
- Finally, a recommendation to the School, Forest Service, and listed partners. (See Executive Summary)

This assessment uses *preliminary* energy savings calculations, project budget estimating, and fuel resource inventory investigation. Preliminary techniques involve cursory field investigation and conceptual level design development and budget estimating. As such, final project economics may vary from those indicated within this document.

Biomass energy is derived from the conversion of any organic material into useful energy, typically thermal, electrical, or chemical energy. This assessment focuses on the implementation of biomass thermal energy at Bonners Ferry High School in Bonners Ferry, Idaho. Although biomass energy can be generated from a variety of feedstocks, the focus of this assessment is on the utilization of forest fuel reduction residue and forest product residue. Biomass energy is commonly applied in the timber industry for process heat, such as drying kilns. Modern, efficient, and clean commercial and institutional applications of biomass energy are quite common in the New England States and Northern Europe, but their expansion to the Western United States has been limited. With increased energy costs, price volatility, and interest in local economic development the interest in biomass energy in the West has been growing very rapidly.

Resource Inventory Summary

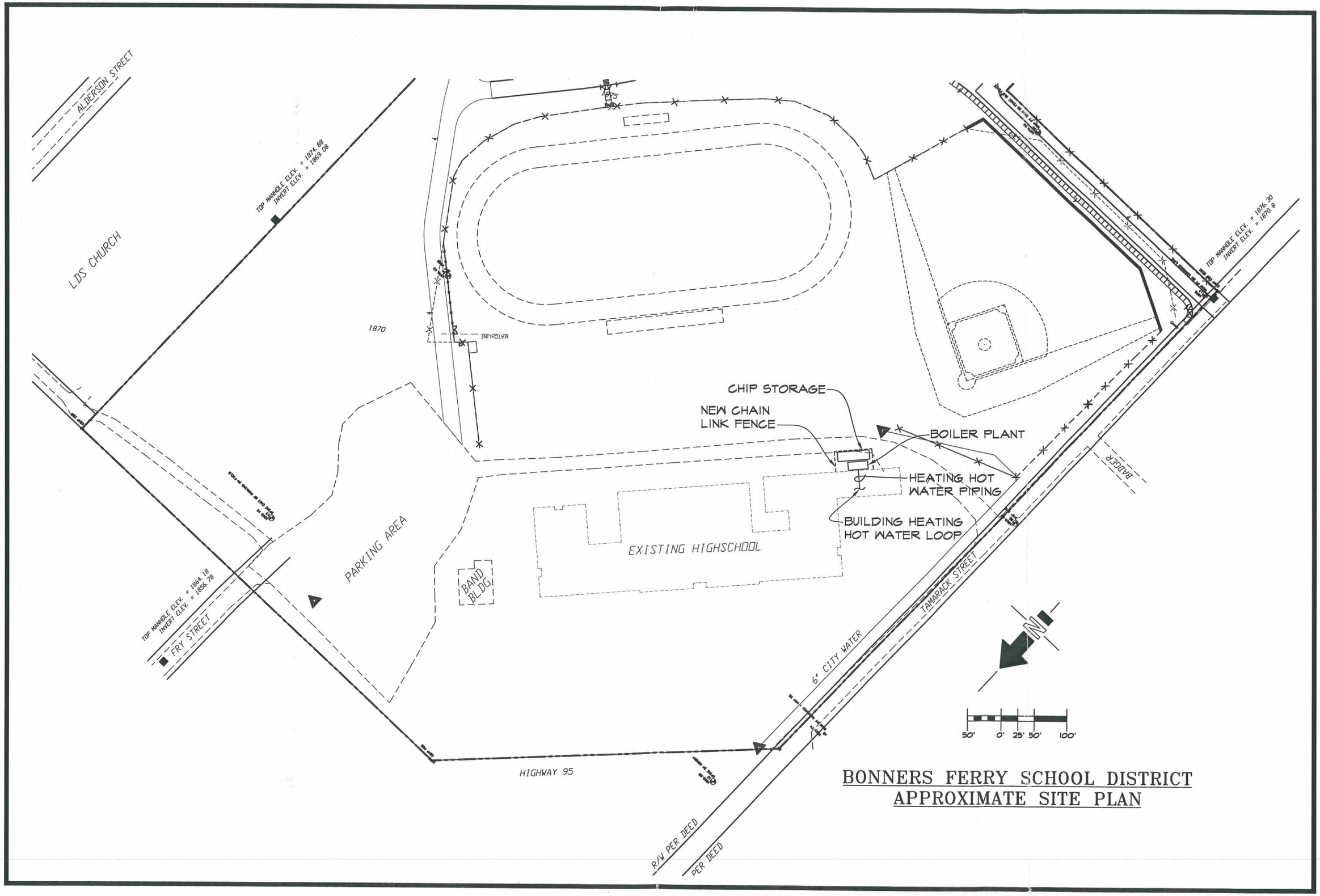
Detailed resource inventory and availability information was not available at the time of this report's release. Upon obtaining this information, a resource inventory summary will be developed and submitted as an addition to this report.

Biomass System Description

A single option was evaluated for integrating biomass heating with the High School at Bonners Ferry. Only one option was developed because of the simplicity of the project conditions. Simplified project conditions include a single building campus (for these evaluation purposed), the ability to locate the Biomass Boiler in close proximity to the facility, and the proposed construction of new heating hot water infrastructure. Appropriate technology for the option was investigated and *preliminary* pricing was secured for the construction of a prefabricated boiler and chip storage facility. This type of plant is factory fabricated with minimal field assembly. General information on this particular type of plant is provided in the Biomass Information appendix section under the King Coal subsection.

It is important to understand that the concepts developed are for the sole purpose of determining the project magnitude. The Conceptual Site Plan indicates locations, site information, and other assumptions used in this analysis.

The Alternative that was analyzed included installing a modular 3 MMBTUH heating hot water plant southeast of the High School Shop (see Preliminary Site Plan). This Alternative provides a heating plant for the entire High School and assumes that the upcoming renovation will convert its heating system to hot water.



BONNERS FERRY SCHOOL DISTRICT
APPROXIMATE SITE PLAN

Evaluation of the Biomass Boiler System

The Biomass Boiler System was evaluated using a 30-year cash flow analysis. Several factors affect the economic analysis of these options:

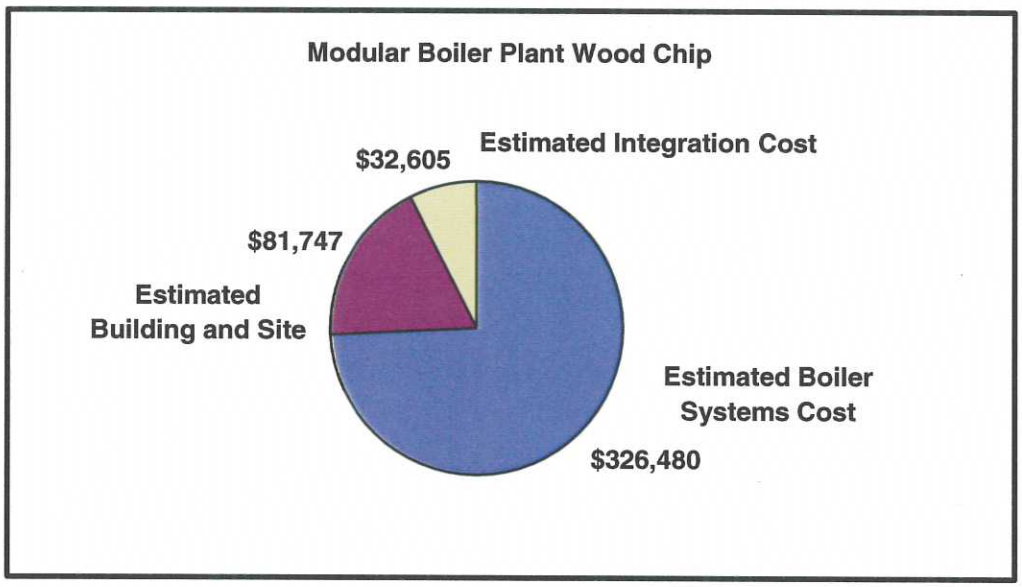
Project Initial Capital Cost

The initial cost of any of the options can be separated into three components:

- Boiler System Costs
- Boiler Plant Building and Site Development
- System Integration

Budget Estimate Summary Table

Title	*Fuel Type*	*Estimated Boiler Systems Cost*	*Estimated Building and Site Cost*	*Estimated Integration Cost*	*Estimated Precontingency Project Total Cost*
Modular Boiler Plant	Wood Chip	$326,480	$81,747	$32,605	$440,832



The breakdown for the Biomass Boiler system into these project components is included in the Budget Estimate Appendix. In addition to these components, the project initial costs will depend on a few specific items. Below a few factors that affect initial cost are discussed.

1. System Integration Summary

The cost of System Integration has an especially important role in the initial cost of a biomass project. The boiler and plant building costs are usually clearly identifiable and able to be estimated. In this assessment, the Biomass Boiler system evaluated includes a central boiler and building, or prepackaged systems that combined the

boiler and building costs. Less obvious are the costs of integrating the system with the existing facilities. Often integration costs are the determinant of a project's economic feasibility. The Conceptual Site Plan provides an idea of the required integration for the described options. Examples of the cost integrating a new heating plant with an existing facility include:

- Underground heating hot water piping. The costs for underground piping alone can be very significant components of project costs. Generally, minimizing the amount of underground piping required is good practice. At Bonner Ferry High School this is accomplished by locating the boiler plant in close proximity to the High School Shop area.

- Interconnection with the newly constructed systems. The actual interconnection at the building to the biomass-heating hot water piping would be connected with the newly constructed heating water system at the High School. If done before a boiler has been installed, then the integration will require installing the Biomass Boiler System in its place with minimal design changes. Close coordination with the High School heating water system design and construction will limit the cost and difficulty of this interconnection regardless of project phasing. The heating hot water system will require some basic controls to enable the plant. Beyond that, the biomass plant controls are PLC based and self-contained.

2. Biomass systems need to have a back up thermal source for instances when the biomass plant is out of service. All boilers in this analysis have been estimated with backup, swing away natural gas burners.

3. At low loads, the biomass plant will not be able to sufficiently turn down to operate efficiently. During these times, the secondary fuel burner will be implemented. It is estimated the Biomass System will provide 85% of the facility's heat.

4. Previous experience indicates that a substantial fire sprinkler system will be required in the boiler room and fuel storage area. An install of a fire sprinkler system in the boiler room is included in cost estimates, however, it is assumed that the remodel of the High School will install a fire sprinkler main that can be extended to the boiler room, eliminating the need to trench a new water line to the boiler room from a City water main. It is also assumed that no additional system development fee will be charged for the interconnection of this sprinkler system.

Fuel Costs and Escalation Rates

Fuel Costs used in the analysis are:

1. Wood Chips (50% MC-9000 btu/lb HHV bone dry) - $6.57/ton delivered inside storage.

2. Natural Gas - $7.67/dekatherm (1 million btu's).

3. Fuel Cost escalation for natural gas was estimated at 6% annually.

4. Fuel Cost for escalation for electricity was estimated at 4% annually.

5. Fuel Cost escalation for wood based fuels was estimated at 2% annually.

Operation and Maintenance Costs

1. Based on discussions with other biomass system users, system manufacturers, and estimates of operator time required, additional operation and maintenance time of 80 to 160 hours per year at $15/hour were assumed.

2. No credit is taken in this analysis for displacement system maintenance, repair, or replacement. The School's existing heating system is electric resistant heat and will be replaced in the upcoming building remodel with a heating hot water system.

Financing Options and Financed Portion

1. Several options exist to finance this project. Below are a few sources that have been identified. Special focus should be given to the State of Idaho Low Interest Energy Loans, and possibly low interest financing by system manufacturers. All of these sources can be funded in part by the resultant energy savings. The cashflow analysis used in this assessment uses 5.21% APR, assuming the use of third party financing is available at this rate. Possible financing mechanisms include:

    - High School financing of project through Idaho Low Interest Energy Loan. An information sheet regarding the program is included in the Financing Appendix.

    - Private sector financing. Options for low interest financing through some system manufacturers exists. Information is included in the Financing Appendix.

    - Fuels for Schools Revolving Loan Fund (information pending development).

    - RC&D Grant Programs.

    - Possible State DEQ support.

    - Possible Electrical Utility support.

Evaluation Procedure

The Biomass Boiler system was developed around the reference fuel of 50% moisture content wood chips with a higher heating value (HHV) of 4500 btu/lb. Option cashflow sheets were developed with the following permutations:

1. Project fully financed by the High School on a 10-year term.

2. Project partially financed by the High School and partially funded by a Fuels for Schools grant to the level required to achieve a 10 year positive accumulated cashflow.

A very large number of permutations of the financial and technical options for this project are possible. The above were chosen to provide a preliminary comparison and evaluation tool. If the High School chooses to further pursue a biomass project, detailed cashflow analysis and sensitivity analysis should be completed.

Congress is presently considering a ten-year term subsidy for the use of forest residue in the form of a $20 per green ton of forest residue utilized. If passed this subsidy would equate to roughly $7,180 per year to the School. As it is speculative at this point, the effect of this subsidy is not included in this analysis.

Results of Evaluation

The results of this analysis are summarized in the Economic Analysis Summary table below. A detailed report of the results is provided in the Cash Flow Analysis Appendix.

One important variable in this analysis is the cost of biomass fuel. The pricing for wood chip in this analysis is based on conversations with providers, other supply contracts, and cost history of these fuels. Variation in their costs may change the recommended fuel. *The finding that can be derived from this is that biomass heating should be implemented with fuel flexibility built in if possible.*

As indicated in the Economic Analysis Summary, the evaluated options achieve a positive accumulated cashflow (PAC) in 16 years. Accumulated cashflow is the primary evaluation measure that is implemented in this report and is similar to simple payback with the exception that accumulated cashflow takes the cost of financing and fuel escalation into account. For many school districts and municipalities, a positive accumulated cashflow of about 10 years maximum is considered for implementation. Based on this standard, the amount of project subsidy required to achieve a 10 year PAC was calculated and is indicated below.

The approach in analyzing the Biomass Boiler System has been to remain conservative, yet realistic about the performance of biomass heating plants and the cost of their installation. Due to the preliminary nature of this assessment, it is possible that the construction cost estimates can be reduced as additional information relative to the construction gathered, favorably affects the economic analysis.

Bonners Ferry Biomass Assessment Economic Analysis Summary

Option Title	*Initial Cost*	*Year Positive Cashflow Occurs at 4.5% APR*	*Year One Energy Savings*	*Project Subsidy Required for 10 year Payback*
Bonners Ferry High School	$440,832	16	$24,636	$141,066

Heat Load Calculation Summary

Heat loads for the Bonners Ferry High School were extracted from a preliminary energy model that was created using the Trace 700. Trace 700 is a modeling program created by the Trane Corporation. Once the model was created the results were then compared

with the actual electrical heating records. From the model the peak-heating load for the High School was determined. The following Heat Energy Summary Table summarizes the projected heating demand and consumption requirements. Complete Energy Data and Trace 700 Calculations are given in the Appendix.

Heat Energy Summary Table

Bonners Ferry Biomass Assessment Heating Summary									
Building	*Floor Area*	*Estimated Building Heating Load (BTU/Hr)*	*Design Plant Capacity Factor for Safety and Expansion*	*Design Plant Capacity (BTU/Hr)*	*Building heat type*	*Existing Annual Heating Plant Fuel Input (KWH)*	*Fuel Type*	*Existing Heating Plant Estimated Efficiency (%)*	*Existing Annual Fuel Consumption (BTU)*
High School	55174	2791000	10%	3070100	electric resistance	724029	Electricity	100%	2471110977
Wood Chips									
Building	**Estimated Wood Chip Plant Efficiency**	**Estimated Biomass plant Input (BTU)**	**Wood Chips 50% MC (BTU/LB)**	**Wood Chip Eqvlnt Mixed conifer chip (lbs)**	**Annual Wood Chip Fuel Consumption (tons)**	**Projected Monthly Maximum Heat Consumption (BTU)**	**Required Chip Storage (tons)**	**Chip density (lb/ft3)**	**One Week Chip Storage (ft3)**
High School	65%	3801709195	4500	844824	422	583592283	65	22	1474

Operations and Maintenance Summary

Biomass Systems do have specific and unique maintenance requirements. However, with proper training and a well-developed maintenance program, the time and cost associated should not be a significant factor in the economic feasibility of the project. General maintenance requirements for a Biomass Boiler System are listed below. Requirements will vary with system type and manufacturer:

- Ash Removal - grates and under grates. Some systems are very automated, requiring little handling of ash. Other systems are more manual. Modern biomass systems produce little ash, requiring ash removal approximately once per week.
- Soot Blowers - Soot blowers are compressed air nozzles that blow the soot from the surface of the boiler's tubes to keep effective heat transfer. They can be automatic, or manual and should be operated at least once per day. The system sizes discussed in this assessment lend themselves best to manual soot blowers.
- Tube Cleaning.
- Cleaning of fire box and heat exchange surfaces.
- Lubrication - Material handling components and blowers.
- Inspection of drive chains, belts, gear boxes.
- Inspection of refactory.
- Inspection/testing of safety devices.
- Combustion calibration (combustion air/fuel feed rate).

Bonners Ferry High School Facility Summary

Information included in this part of the assessment is based on general observations from a site visit on June 25, 2003. Mechanical plans were not available. The observations are very cursory in nature, many undiscovered conditions may exist that could affect the construction of any biomass plant option. The observations are also focused on the heat generation facilities at each building and not on the buildings themselves. The purpose of this assessment is to review the potential for integrating biomass heating, as such little time was spent investigating the buildings' conditions, nor the mechanical systems that distribute the heat.

Bonners Ferry High School

The Bonners Ferry High School consists of two major structures, the main High School Building and the Shop Building. Although they are connected, the two structures are of two completely different construction types.

The High School completed construction in 1970 and is primarily masonry construction. The building is roughly 55,175 square feet and is comprised of class space, cafeteria, gymnasium, administrative, and shop spaces. The heating system is comprised of electric resistant heat. Domestic hot water is provided by gas-fired water heaters. This building uses approximately 44,775 btu/sf of heating energy on an annual basis.

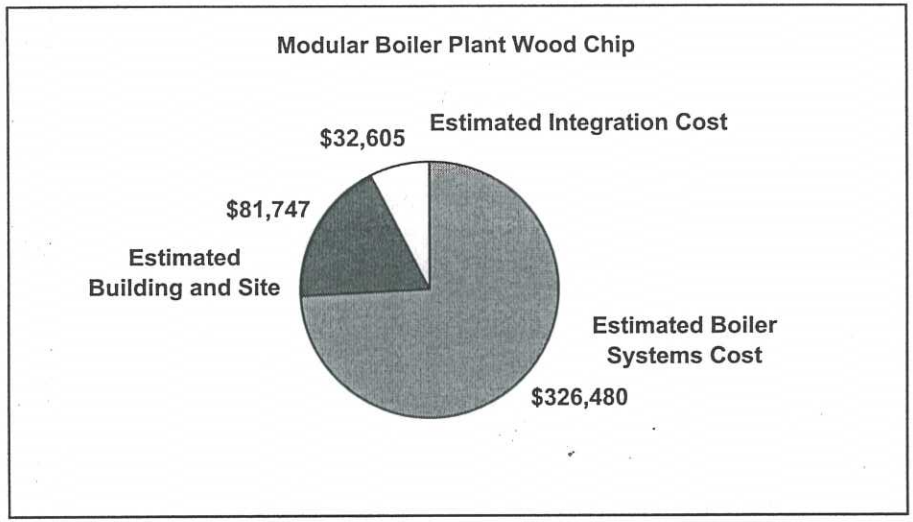
Detailed energy use information is provided in the Energy Data and Trace 700 Calculations Appendix. Independent of Bonners Ferry High School's decision regarding biomass energy, a concerted effort to reduce energy consumption and improve efficiency in the buildings is recommended.

Appendix

BUDGET ESTIMATES

BUDGET ESTIMATE SUMMARY

Option	Title	Fuel Type	Estimated Boiler Systems Cost	Estimated Building and Site Cost	Estimated Integration Cost	Estimated Precontingency Project Total Cost
A	Prefabricated Boiler Plant at High School	Wood Chip	$326,480	$81,747	$32,605	$440,832



CONSTRUCTION COST ESTIMATE	DATE PREPARED 8/4/03	SHEET 1 OF 1

PROJECT
Bonners Ferry High School Biomass Heating Assessment

Option

Stevenson

CTA Architects Engineers
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406. 248. 7455 800. 780. 7455 Fax: 406. 248. 3779
1-800-780-7455
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Bonners Ferry High School Biomass Heating System

ESTIMATOR
Stevenson

	QUANTITY		MATERIAL		LABOR			
	No. Units	Unit Meas.	Per Unit	TOTAL	Per Unit	TOTAL	TOTAL COST	PROJECT COMPONENT COST
BIOMASS BOILER SYSTEM								
High School Boiler Plant (85 hp)	1	assy	$205,000.00	$205,000.00	$100,000.00	$100,000.00	$305,000.00	
Crane	1				$3,000.00	$3,000.00	$3,000.00	
Subtotal							$308,000.00	
General Contractors Markup								
Design Services	6%						$18,480.00	
TOTAL- BIOMASS BOILER SYSTEMS								**$326,480.00**
BOILER BUILDING COSTS								
Elementary and Middle School Plant								
Site prep and concrete slab for Modules (60x40)	2400	sf	$4.00	$9,600.00	$4.00	$9,600.00	$19,200.00	
Site fill and compaction	355	cy	$5.00	$1,775.00	$5.00	$1,775.00	$3,550.00	
Plant water service								
Trenched 4" HDPE	40	lf	$6.15	$246.00	$3.00	$120.00	$366.00	
RPBFP	2	ea	$2,000.00	$4,000.00	$500.00	$1,000.00	$5,000.00	
Building entrance work	1	assy	$1,000.00	$1,000.00	$1,000.00	$1,000.00	$2,000.00	
Domestic water plumbing	1	assy	$1,000.00	$1,000.00	$1,000.00	$1,000.00	$2,000.00	
Extra hazard sprinklers	2064	sf	$4.00	$8,256.00	$4.00	$8,256.00	$16,512.00	
sewer service								
ewage Ejector	1	ea	$370.00	$370.00	$170.00	$170.00	$540.00	
Trenched 2" HDPE discharge piping	150	lf	$1.00	$150.00	$1.00	$150.00	$300.00	
Route to Sewer in school	1	ea	$100.00	$100.00	$200.00	$200.00	$300.00	
Boiler Blowdown routed to existing boiler room	150	lf	$2.00	$300.00	$2.00	$300.00	$600.00	
Plant electrical service-elementary and middle school plant	1	svc	$7,000.00	$7,000.00	$7,000.00	$7,000.00	$14,000.00	
Subtotal							*$64,368.00*	
General Contractors Markup	*15%*						*$9,655.20*	
Design Services	*12%*						*$7,724.16*	
TOTAL- BOILER BUILDING COSTS								**$81,747.36**
MECHANICAL INTEGRATION COSTS								
High School								
4" preinsulated underground piping	40	lf	$105.00	$4,200.00	$25.00	$1,000.00	$5,200.00	
Plant piping (field piping)	1	assy	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$10,000.00	
Pumping station	1	assy	$5,150.00	$5,150.00	$2,925.00	$2,925.00	$8,075.00	
Interconnect at School	1	labor	$1,000.00	$1,000.00	$1,000.00	$1,000.00	$2,000.00	
Subtotal							*$25,275.00*	
General Contractors Markup	*15%*						*$3,791.25*	
Design Services	*14%*						*$3,538.50*	
TOTAL- MECHANICAL INTEGRATION COSTS								**$32,604.75**
PRECONTINGENCY PROJECT TOTAL								**$440,832.11**
CONTINGENCY	15%							$66,124.82
RECOMMENDED PROJECT BUDGET								**$506,956.93**

CASHFLOW ANALYSIS

Bonners Ferry Biomass Assessment Heating Summary

Building	Floor Area	Estimated Building Heating Load (BTU/Hr)	Design Plant Capacity Factor for Safety and Expansion	Design Plant Capacity (BTU/Hr)	Building heat type	Existing Annual Heating Plant Fuel Input (KWH)	Fuel Type	Existing Heating Plant Estimated Efficiency (%)	Existing Annual Fuel Consumption (BTU)
High School	55174	2791000	10%	3070100	electric resistance	724029	Electricity	100%	2471110977

Wood Chips

Building	Estimated Wood Chip Plant Efficiency	Estimated Biomass plant Input (BTU)	Wood Chips 50% MC (BTU/LB)	Wood Chip Eqvlnt Mixed conifer chip (lbs)	Annual Wood Chip Fuel Consumption (tons)	Projected Monthly Maximum Heat Consumption (BTU)	Required Chip Storage (tons)	Chip density (lb/ft3)	One Week Chip Storage (ft3)
High School	65%	3801709195	4500	844824	422	583592283	65	22	1474

Bonners Ferry Biomass Assessment Economic Analysis Summary

Option Title	Initial Cost	Year Positive Cashflow Occurs at 4.5% APR	Year One Energy Savings	Project Subsidy Required for 10 year Payback
Prefabricated 3MMBTUH wood chip fired plant located at High School	$594,818	17	$23,119	$297,000

Bonners Ferry High School Biomass Heating Economic Analysis

Conversion Proforma for Bonners Ferry High School - 4.5% APR 100% Financed - 10 Year Term

August 4, 2003
Revision:2
Analyst: Stevenson-CTA

Project Capital Cost	-$440,832

$593,000

Project Financing Information	
Percent Financed	100%
Amount Financed	-$440,832
Amount of Grants	$0
Interest Rate	5.21%
Term	10
Annual Finance Cost (years)	-$57,676

$303,000

Year One Fuel Price:		
Wood Chips	$6.57	/ton
Pellets	$70.00	/ton
Fuel Oil		/gallon
Propane		/gallon
Natural Gas	$7.67	/mmbtu
Electric	$0.0449	/kwh

$7.80

Escalation factors	
Elec. Escalation factor	1.04
Natural Gas Escalation factor	1.04
Fuel Oil Escalation factor	1.04
Pellet Escalation factor	1.03
Green Chip Escalation factor	1.02
Maint. Escalation factor	1.03

Cashflow Descriptions	Unit Costs	Heating Source Proportion	Annual Heating Source Volumes	Heating Units	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Existing Heating System Operating Costs																			
Displaced electric resistance heating costs	$0.045		724029	KWH	32,509	33,809	35,162	36,568	38,031	39,552	41,134	42,779	44,491	46,270	48,121	50,046	52,048	54,130	56,295
Displaced Operation and Maintenance Costs					570	587	605	623	642	661	681	701	722	744	766	789	813	837	862
Biomass System Operating Costs																			
Green Chip Fuel ($/ton, delivered to boiler site, btu/lb) (90% of total heat rqmnt)	$6.57	85%	422	tons	2,359	2,406	2,454	2,503	2,553	2,604	2,657	2,710	2,764	2,819	2,876	2,933	2,992	3,052	3,113
Small load natural gas (10% of total heat rqmnt)	$7.67	15%	3802	full load MMBtu	4,374	4,549	4,731	4,920	5,117	5,321	5,534	5,756	5,986	6,225	6,474	6,733	7,003	7,283	7,574
Operation and Maintenance Costs					1,710	1,761	1,814	1,869	1,925	1,982	2,042	2,103	2,166	2,231	2,298	2,367	2,438	2,511	2,587
Annual Operating Cost Savings					*24,636*	*25,680*	*26,767*	*27,899*	*29,078*	*30,305*	*31,582*	*32,912*	*34,297*	*35,738*	*37,239*	*38,801*	*40,428*	*42,121*	*43,884*
Financed Project Costs - Principal and Interest					*(57,676)*	*(57,676)*	*(57,676)*	*(57,676)*	*(57,676)*	*(57,676)*	*(57,676)*	*(57,676)*	*(57,676)*	*(57,676)*					
Displaced System Replacement Costs					*60,000*														
Special financing																			
USDA Green ton subsidy (Note 1) ($/ton, Green chip tons/year) (Notes 5&6)	$0.00		359		0	0	0	0	0	0	0	0	0	0					
Net Annual Cash Flow					*26,960*	*(31,996)*	*(30,909)*	*(29,777)*	*(28,599)*	*(27,372)*	*(26,094)*	*(24,764)*	*(23,380)*	*(21,938)*	*37,239*	*38,801*	*40,428*	*42,121*	*43,884*
Cumulative Cash Flow					*26,960*	*(5,036)*	*(35,945)*	*(65,723)*	*(94,321)*	*(121,693)*	*(147,787)*	*(172,551)*	*(195,931)*	*(217,869)*	*(180,630)*	*(141,828)*	*(101,400)*	*(59,279)*	*(15,395)*

Cashflow Descriptions	Unit Costs	Heating Source Proportion	Annual Heating Source Volumes	Heating Units	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30
Existing Heating System Operating Costs																			
Displaced electric resistance heating costs	$0.000		724029	KWH	58,547	60,889	63,324	65,857	68,491	71,231	74,080	77,043	80,125	83,330	86,663	90,130	93,735	97,485	101,384
Displaced Operation and Maintenance Costs					888	915	942	970	999	1,029	1,060	1,092	1,125	1,159	1,193	1,229	1,266	1,304	1,343
Biomass System Operating Costs																			
Green Chip Fuel ($/ton, delivered to boiler site, btu/lb) (90% of total heat rqmnt)	$9.00	85%	422	tons	3,175	3,238	3,303	3,369	3,437	3,505	3,575	3,647	3,720	3,794	3,870	3,948	4,026	4,107	4,189
Small load natural gas (10% of total heat rqmnt)	$7.67	15%	3802	full load MMBtu	7,877	8,192	8,520	8,861	9,215	9,584	9,967	10,366	10,780	11,212	11,660	12,126	12,611	13,116	13,641
Operation and Maintenance Costs					2,664	2,744	2,826	2,911	2,998	3,088	3,181	3,277	3,375	3,476	3,580	3,688	3,798	3,912	4,030
Annual Operating Cost Savings					*45,719*	*47,629*	*49,617*	*51,686*	*53,841*	*56,083*	*58,417*	*60,846*	*63,375*	*66,007*	*68,746*	*71,597*	*74,565*	*77,653*	*80,868*
Financed Project Costs - Principal and Interest																			
Displaced System Replacement Costs																			
Special financing																			
USDA Green ton subsidy (Note 1) ($/ton, Green chip tons/year) (Notes 5&6)	$0.00		359																
Net Annual Cash Flow					*45,719*	*47,629*	*49,617*	*51,686*	*53,841*	*56,083*	*58,417*	*60,846*	*63,375*	*66,007*	*68,746*	*71,597*	*74,565*	*77,653*	*80,868*
Cumulative Cash Flow					*30,324*	*77,952*	*127,569*	*179,256*	*233,096*	*289,179*	*347,596*	*408,443*	*471,818*	*537,825*	*606,571*	*678,169*	*752,734*	*830,387*	*911,255*

Bonners Ferry High School Biomass Heating Economic Analysis

Conversion Proforma for Bonners Ferry High School - 4.5% APR, $141,000 Grant - 10 Year Term

August 4, 2003
Revision:2
Analyst: Stevenson-CTA

Project Capital Cost	-$440,832

Project Financing Information	
Percent Financed	68%
Amount Financed	-$299,766
Amount of Grants	-$141,066
Interest Rate	5.211%
Term	10
Annual Finance Cost (years)	-$39,220

Year One Fuel Price:		
Wood Chips	$6.57	/ton
Pellets	$70.00	/ton
Fuel Oil		/gallon
Propane		/gallon
Natural Gas	$7.67	/mmbtu
Electric	$0.0449	/kwh

Escalation factors	
Elec. Escalation factor	1.04
Natural Gas Escalation factor	1.04
Fuel Oil Escalation factor	1.04
Pellet Escalation factor	1.03
Green Chip Escalation factor	1.02
Maint. Escalation factor	1.03

Cashflow Descriptions	Unit Costs	Heating Source Proportion	Annual Heating Source Volumes	Heating Units	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Existing Heating System Operating Costs																			
Displaced electric resistance heating costs	$0.045		724029	KWH	32,509	33,809	35,162	36,568	38,031	39,552	41,134	42,779	44,491	46,270	48,121	50,046	52,048	54,130	56,295
Displaced Operation and Maintenance Costs					570	587	605	623	642	661	681	701	722	744	766	789	813	837	862
Biomass System Operating Costs																			
Green Chip Fuel ($/ton, delivered to boiler site, btu/lb) (90% of total heat rqmnt)	$6.57	85%	422	tons	2,359	2,406	2,454	2,503	2,553	2,604	2,657	2,710	2,764	2,819	2,876	2,933	2,992	3,052	3,113
Small load natural gas (10% of total heat rqmnt)	$7.67	15%	3802	full load MMBtu	4,374	4,549	4,731	4,920	5,117	5,321	5,534	5,756	5,986	6,225	6,474	6,733	7,003	7,283	7,574
Operation and Maintenance Costs					1,710	1,761	1,814	1,869	1,925	1,982	2,042	2,103	2,166	2,231	2,298	2,367	2,438	2,511	2,587
Annual Operating Cost Savings					*24,636*	*25,680*	*26,767*	*27,899*	*29,078*	*30,305*	*31,582*	*32,912*	*34,297*	*35,738*	*37,239*	*38,801*	*40,428*	*42,121*	*43,884*
Financed Project Costs - Principal and Interest					*(39,220)*	*(39,220)*	*(39,220)*	*(39,220)*	*(39,220)*	*(39,220)*	*(39,220)*	*(39,220)*	*(39,220)*	*(39,220)*					
Displaced System Replacement Costs					*60,000*														
Special financing																			
USDA Green ton subsidy (Note 1) ($/ton, Green chip tons/year) (Notes 5&6)	$0.00		359		0	0	0	0	0	0	0	0	0	0					
Net Annual Cash Flow					*45,416*	*(13,540)*	*(12,453)*	*(11,321)*	*(10,142)*	*(8,915)*	*(7,638)*	*(6,308)*	*(4,923)*	*(3,482)*	*37,239*	*38,801*	*40,428*	*42,121*	*43,884*
Cumulative Cash Flow					*45,416*	*31,877*	*19,424*	*8,103*	*(2,039)*	*(10,955)*	*(18,592)*	*(24,900)*	*(29,823)*	*(33,305)*	*3,934*	*42,736*	*83,164*	*125,285*	*169,169*

Cashflow Descriptions	Unit Costs	Heating Source Proportion	Annual Heating Source Volumes	Heating Units	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30
Existing Heating System Operating Costs																			
Displaced electric resistance heating costs	$0.000		724029	KWH	58,547	60,889	63,324	65,857	68,491	71,231	74,080	77,043	80,125	83,330	86,663	90,130	93,735	97,485	101,384
Displaced Operation and Maintenance Costs					888	915	942	970	999	1,029	1,060	1,092	1,125	1,159	1,193	1,229	1,266	1,304	1,343
Biomass System Operating Costs																			
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Small load natural gas (10% of total heat rqmnt)	$7.67	15%	3802	full load MMBtu	7,877	8,192	8,520	8,861	9,215	9,584	9,967	10,366	10,780	11,212	11,660	12,126	12,611	13,116	13,641
Operation and Maintenance Costs					2,664	2,744	2,826	2,911	2,998	3,088	3,181	3,277	3,375	3,476	3,580	3,688	3,798	3,912	4,030
Annual Operating Cost Savings					*45,719*	*47,629*	*49,617*	*51,686*	*53,841*	*56,083*	*58,417*	*60,846*	*63,375*	*66,007*	*68,746*	*71,597*	*74,565*	*77,653*	*80,868*
Financed Project Costs - Principal and Interest																			
Displaced System Replacement Costs																			
Special financing																			
USDA Green ton subsidy (Note 1) ($/ton, Green chip tons/year) (Notes 5&6)	$0.00		359																
Net Annual Cash Flow					*45,719*	*47,629*	*49,617*	*51,686*	*53,841*	*56,083*	*58,417*	*60,846*	*63,375*	*66,007*	*68,746*	*71,597*	*74,565*	*77,653*	*80,868*
Cumulative Cash Flow					*214,887*	*262,516*	*312,133*	*363,819*	*417,660*	*473,743*	*532,160*	*593,007*	*656,382*	*722,389*	*791,135*	*862,733*	*937,298*	*1,014,951*	*1,095,819*

FINANCING INFORMATION

Government Capital Corporation

345 Miron Drive Southlake (Fort Worth), Texas 76092
Web: www.governmentcapital.com Email: don@ governmentcapital.com
Phone: **(800) 883-1199** or (817) 421-5400 Fax: (817) 488-8477

Mr. Dan Stevenson
CTA Architects Engineers
P.O. Box 1439
Billings, MT 59103

August 5, 2003
Email: dans@ctagroup.com
Phone: (406) 248-7455

Dear Dan:

Thank you for allowing Government Capital Corporation (GCC) the opportunity to provide a Municipal Lease Purchase of the Biomass Heating Plant for the Bonner's Ferry High School. We are pleased to present the following proposal.

LESSOR:	Government Capital Corporation	
LESSEE:	Bonner's Ferry High School, Idaho	
EQUIPMENT:	Biomass Heating Plant, to specifications	
EQUIPMENT COST:	Approximately $440,000.00	
CONTRACT CLOSING DATE:	Within 30 days of this proposal date anticipated	
DELIVERY:	To customer requirements	
FEE's:	None	
PURCHASE OPTION:	$1.00 due upon completion of contract	
TERM:	10 Years*	15 Years*
PAYMENTS COMMENCING:	July 15, 2004 and annually thereafter	
EFFECTIVE INTEREST RATE:	5.211%	5.324%
PAYMENT FACTOR:	0.130385	0.098118
PAYMENT:	$57,369.50	$43,171.81

Note*: Rate adjusted following receipt of the 5th and 10th annual payment, indexed to the then current Treasury Bill rate.

If the amount to be financed is other than as stated above, multiply the actual equipment cost by the payment factor to calculate the correct payment.

GCC can tailor a financial program to your client's specific needs. The above proposal is subject to audit analysis, documentation, and bank qualifications. If closing occurs more than 30 days from proposal issue date, GCC reserves the right to index the rate to the current market. The effective interest rate represents the total cost of borrowing which may include the effects of interest from escrow accounts and financing origination.

This transaction will be structured as a Municipal Lease Purchase Agreement specifically for tax-exempt municipal entities and will contain the usual clauses required to include $1.00 purchase option, early payoff privileges, suitable appropriations provisions, etc. Samples of the proposed lease documents are available.

If you would like to proceed with this financing, if you have any questions regarding this proposal or if you would like to consider including additional equipment, other payment terms, frequencies or conditions, please feel free to call me at **(800) 883-1199** or email me at don@governmentcapital.com. I'm looking forward to hearing from you.

Sincerely,

Don Pyle
Public Finance

Government Capital Corporation

Business Profile

DESCRIPTION

With vast experience in the investment banking and public finance industry, the staff at **Government Capital Corporation** provides financing for municipalities, school districts, counties, not-for-profit corporations, governmental agencies, hospitals, colleges and universities. Government Capital Corporation, having over 3,000 clients in both the public and private sectors, has gained the experience required to consistently provide cost effective and timely closings in many facets of the public finance industry. The following represents a summary of the types of transactions and services provided throughout 40 states and Puerto Rico.

Lease/Purchase Financing - Essential purpose equipment for municipalities can be leased in a timely and cost effective manner on a tax-exempt basis.

Taxable Leases - Structuring of transactions; creation of documentation; issuance and sale.

Refunding - Structuring of issues to refund existing leases or loans at lower costs to capture optimal windows of opportunity.

Higher Education - As not-for-profit institutions, most public, private and tribal colleges and universities may issue tax-exempt debt through a governmental authority, such as a state higher-education finance agency or Tribal Government.

Health Care - Not-for-profit health care institutions are eligible to finance capital projects on a tax-exempt basis.

Not-for-Profit C haritable C orporations - T he capital requirements of this area qualify for tax-exempt financing. Museums and other not-for-profit charitable organizations are often organized on this basis.

ADDITIONAL SERVICES PROVIDED

Assisting in the structuring of each issuance to meet the individual needs of each participant.

Assisting in the preparation and execution of all financing documentation.

Providing current interest rate quotations and amortization schedules to assist in the budgetary process.

Assisting in the restructuring and/or refinancing of any current lease/purchase agreements.

Providing expertise in structuring escrow agreements to provide for incremental disbursements for transactions requiring longer installation periods or multiple vendor participation.

The GCC Advantage

Experience

With vast experience in the investment banking and public finance industry, the staff at Government Capital Corporation has provided financing for municipalities, school districts, counties, and other special districts nationwide with cost effective financial solutions.

Competitive

Government Capital Corporation provides one of the regions most sophisticated and cost effective placement networks. This network continually serves the financial needs of tax-exempt issuers, as well as equipment suppliers and finance companies serving the public sector.

Flexible

Government Capital Corporation assists in the structuring of each transaction. With options ranging from no down payment to deferred payments, Government Capital Corporation designs each transaction to meet the individual needs of each issuer.

Responsive

Upon notification of your desire to arrange financing, funds can be available for your disbursement in 2 to 3 weeks for transactions and 60-75 days for capital improvement construction projects.

Quality

At Government Capital Corporation, the quality of service has become a tradition. Throughout the structuring, execution and servicing of each transaction, clients can expect to be assisted by knowledgeable professionals dedicated to provide the highest level of quality service in the industry.

Advantages to Lease/Purchase Financing

- **Bond Election Not Required**
  In most cases, a bond election is not required. Because of the annual appropriation feature, tax-exempt municipal financings are not counted against the municipality's debt limit nor are they subject to normal debt incurrence procedures.

- **Flexible Terms**
  Lease terms generally are matched to the useful life of the equipment to be financed. The flexibility of monthly, quarterly, semi-annual or annual payments provides for easy budgeting.

- **Builds Equity**
  Unlike rentals, a lease/purchase program permits the lessee to build equity with each payment. At the end of the lease term the lessee owns the equipment upon remittance of one dollar ($1.00).

- **Avoids Inflation Delay Costs**
  A lease/purchase obligation permits acquisition of needed equipment today before prices rise still further. There is no need to build up capital improvement funds until an outright purchase is possible, while watching inflation stay one or two steps ahead of purchasing power.

- **Debt Limitation**
  Unlike other ways of obtaining funds, lease/purchase financing does not affect debt limitation. Debt to fund balance ratios are very important in keeping a good rating as well as staying within statutory requirements.

- **Quick Response**
  Funds for equipment purchases can usually be made available in a matter of days after the municipality has completed the initial lease application form. This is particularly important in times of emergency when bond proceeds might not be available for weeks or even months and the municipality needs the equipment immediately.

- **Emergency Purchase**
  Most state laws allow a governing body to purchase equipment without going through the bid process whenever an emergency is declared. A lease/purchase program can be very useful in an emergency purchase.

- **Pre-Payment Options**
  Unlike general obligation bonds, our municipal lease/purchase agreement provides an option to purchase value at every payment date.

HOW WE CAN HELP YOU

THE FOLLOWING REPRESENTS A PARTIAL LISTING OF WHAT MAY BE FINANCED THROUGH OUR FINANCING STRUCTURES

Jail Facilities
Law Enforcement Equipment/Vehicles
Fire Stations
New & Used Fire Trucks
Fire & Safety Equipment
Communication Equipment
Video Equipment
Ambulances
Medical Equipment
CAT Scan Machines
Garbage Trucks
Garbage Handling Equipment
Street Sweepers
Excavators
Bulldozers
Backhoes
Street Improvement Projects
Cafeteria Equipment
Air Conditioning/Heating
Buses & Transportation
School Facilities
Recreation Facilities
Public Housing Projects

Libraries
Education Equipment
Computer Hardware & Software
Generators
Telephone Systems
Energy Management Systems
Sewer Treatment Systems & Equipment
Fresh Water Treatment Systems & Equipment
Real Estate (Land and Buildings)
Airport Equipment
Parking Meters
Material Recovery Equipment
Modular Buildings
Copiers
Service Contracts
Gas Conversion Equipment
Brake Retarders
Maintenance Equipment
Classroom Equipment
Furniture
Irrigation Projects
Health Facilities
Community Centers

Energy Information:

- Staff & Organization
- Idaho Currents News
- Low Interest Energy Loans
- Idaho Energy Star Home Program
- Northwest Energy Efficient Manufactured Home Program
- Industries of the Future (IOF)
- Rebuild Idaho
- Energy Performance Contracting
- Building Commissioning
- Business & Commercial
- Government & Higher Education
- Schools Primary & Secondary
- Efficient Irrigation
- Bioenergy
- Geothermal
- Solar
- Wind

Need More Information?

Ask an Energy Specialist
Do you have a specific energy question? If so, then maybe an email to the Idaho Energy Division's Energy Specialists can assist you with answering it and more.

Energy Code Information
Contact Ingo Stroup,
208-332-7153
Senior Energy Specialist
Division of Building Safety with all your Energy Code Questions.

Idaho Energy Division
1301 North Orchard Street
Boise, Idaho 83706
(208) 327-7900

Idaho Energy Division Hotline

Low Interest Energy Loans

Welcome to the Financial Assistance team. Our mission is to support the c of the Energy Division by providing financial assistance to individuals and for programs and projects that result in the conservation of energy and/or renewable resources within the state of Idaho.

Program Description:

- Energy Conservation or Renewable Energy
- 4% Interest
- 5 Year Loan Repayment

- Energy savings must be at least 10% of the project cost
- A $2,000.00 project must save $200.00 a year

- Residential Loans: $1,000 to $10,000
- Commercial Loans: $1,000 to $100,000
- Agricultural Loans: up to $100,000
- Renewable Loans: $1,000 to $100,000
- Schools, Hospitals and Health Care Facilities: $1,000 to $100,000

For Additional Information

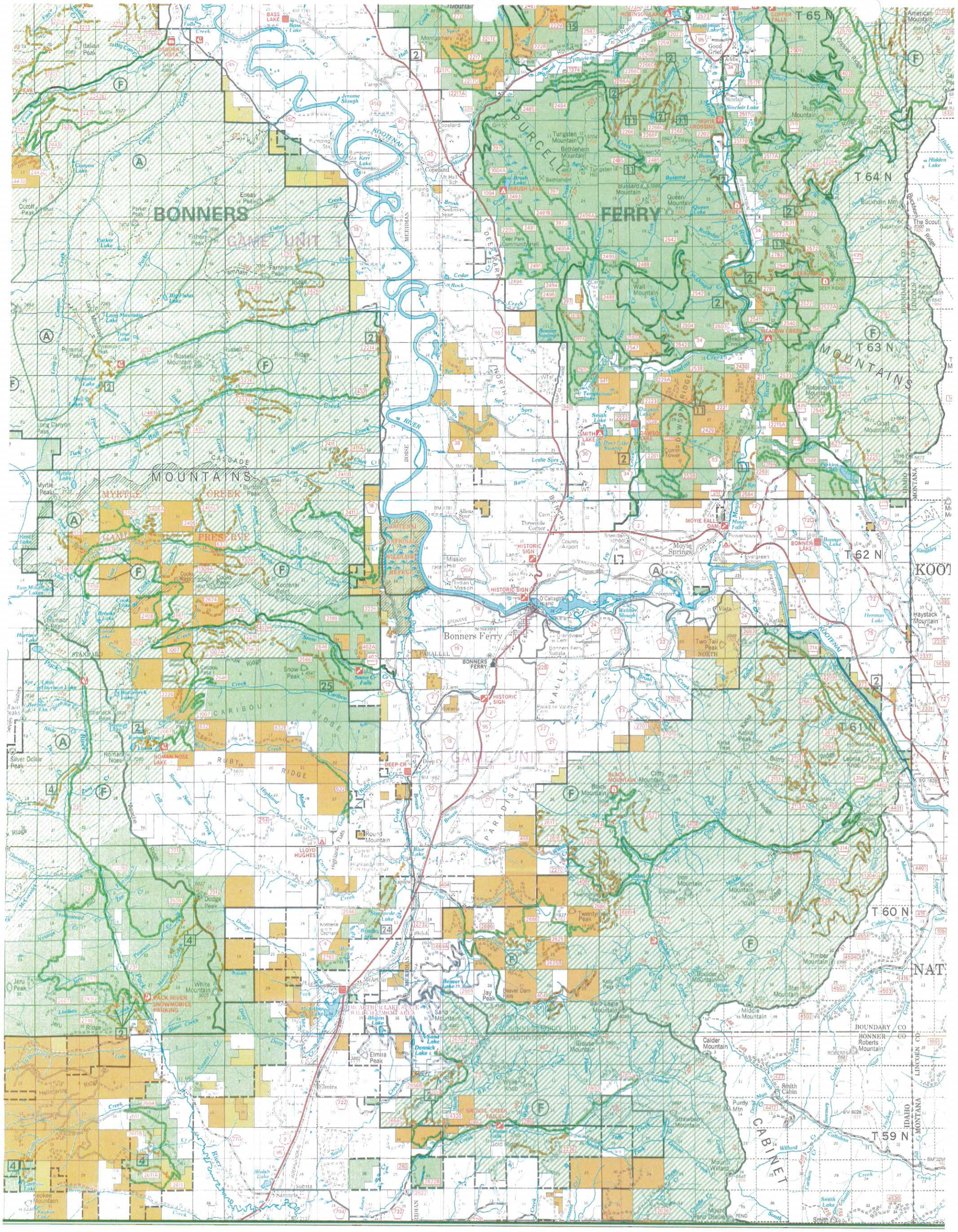
Contact:

Renee Arellanes

Terry Hoebelheinrich

Cheryl Wilson

DATA AND PHOTOS



BONNERS FERRY

REGIONAL RESOURCE MAP

ENERGY CONSUMPTION SUMMARY

By cta

	Elect Cons. (kWh)	Gas Cons. (therms)	Percent of Total Energy	Total Source Energy* (kBtu/yr)
Primary heating				
Primary heating	724,029.3		51.7 %	74,140.8
Primary cooling				
Cooling Compressor			0.0 %	0.0
Tower/Cond Fans			0.0 %	0.0
Condenser Pump			0.0 %	0.0
Other CLG Accessories			0.0 %	0.0
Cooling Subtotal....			0.0 %	0.0
Auxiliary				
Supply Fans	191,302.7		13.7 %	19,589.4
Circ Pumps			0.0 %	0.0
Base Utilities		8,083.8	16.9 %	8,509.3
Aux Subtotal....	191,302.7	8,083.8	30.6 %	28,098.7
Lighting				
Lighting	206,053.7		14.7 %	21,100.0
Receptacle				
Receptacles	41,095.6		2.9 %	4,208.2
Heating plant load				
Base Utilities			0.0 %	0.0
Cogeneration				
Cogeneration			0.0 %	0.0
Totals				
Totals**	1,162,481.3	8,083.8	100.0 %	127,547.6

* Note: Resource Utilization factors are included in the Total Source Energy value.
** Note: This report can display a maximum of 6 utilities. If additional utilities are used, they will be included in the total.

Project Name: Bonners Ferry High School
Dataset Name: C:\CDS\TRACE700\Projects\bonnersferry osa.trc

MONTHLY ENERGY CONSUMPTION

By cta

Alternative: 1

Utility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
	------- Monthly Energy Consumption -------												
Electric													
On-Pk Cons. (kWh)	204,298	119,947	117,313	90,609	59,785	30,147	26,191	28,001	57,286	78,006	140,001	210,897	1,162,481
On-Pk Demand (kW)	912	842	826	769	708	529	165	249	712	744	821	904	912
Gas													
On-Pk Cons. (therms)	832	752	911	792	871	132	120	138	852	937	895	852	8,084
On-Pk Demand (therms/hr)	6	6	6	6	6	6	6	6	6	6	6	6	6

Building Energy Consumption = 86,562 Btu/(ft2-year)
Source Energy Consumption = 231,175 Btu/(ft2-year)
Floor Area = 55,174 ft2

EQUIPMENT ENERGY CONSUMPTION

By cta

Equipment - Utility		Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
		------- Monthly Consumption -------												
Lights														
	Electric (kWh)	20,299.5	18,353.0	21,411.8	19,465.3	20,855.6	8,342.3	8,620.3	8,620.3	19,465.3	20,855.6	20,021.4	19,743.4	206,053.7
	Peak (kW)	115.9	115.9	115.9	115.9	115.9	115.9	115.9	115.9	115.9	115.9	115.9	115.9	115.9
MISC LD														
	Electric (kWh)	4,110.1	3,718.7	4,501.6	3,914.4	4,305.8	1,455.5	1,323.2	1,521.7	3,914.4	4,305.8	4,110.1	3,914.4	41,095.6
	Peak (kW)	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6	27.6
Domestic Hot Water (gas)														
	Gas (therms)	831.6	752.4	910.8	792.0	871.2	132.0	120.0	138.0	852.0	937.2	894.6	852.0	8,083.8
	Peak (therms/Hr)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Cooling plant - 003														
Heating plant - 002														
Electric Resistance - 001 (Heating Equipment)														
	Electric (kWh)	163,641.1	83,200.1	75,152.3	51,505.6	18,375.9	4,626.1	0.0	1,611.2	18,182.7	36,597.1	100,145.9	170,991.3	724,029.3
	Peak (kW)	818.0	748.5	732.0	675.0	614.9	435.3	62.7	212.6	618.8	650.5	727.1	810.7	818.0
System - 001														
Eq4003 - FC Centrifugal const vol (Main Htg Fan)														
	Electric (kWh)	16,247.6	14,675.3	16,247.6	15,723.5	16,247.6	15,723.5	16,247.7	16,247.6	15,723.5	16,247.6	15,723.5	16,247.6	191,302.7
	Peak (kW)	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8

Gas Billing History for GAS SVC No. 00182975
at: 6577 MAIN ST BONNERS FERRY ID 83805
Route: 030923 Premise No.: 2965

Current account #1129103 Customer: SCHOOL DISTRICT #101,
Mailing address:

Box 899
BONNERS FERRY ID 83805

Service status: OPEN 08-19-1970
Rate schedule: 101 FIRM AND GENERAL SERVICE

>From 2002-03-06 to 2003-07-02 (483 days of service)
Total usage: 9,025 Total billing: $7,590.08

Read End Date Read	RBC	Dys Svc	Deg Dys	Usage	Tax Amt	Billed Amt	Mult	Begin Read
2003-07-02	RR	33	101	309	7.12	244.38	1.10	25493
25774								
2003-05-30	RR	29	354	413	9.48	325.49	1.11	25124
25493								
2003-05-01	RR	29	553	535	12.25	420.64	1.10	24638
25124								
2003-04-02	RR	30	694	736	16.82	577.41	1.10	23971
24638								
2003-03-03	RR	31	981	922	21.04	722.48	1.09	23131
23971								
2003-01-31	RR	28	874	869	19.84	681.14	1.09	22338
23131								
2003-01-03	RR	31	938	958	21.86	750.56	1.10	21469
22338								
2002-12-03	RR	29	793	749	17.11	587.55	1.10	20789
21469								
2002-11-04	RY	33	776	778	20.65	708.98	1.10	20083
20789								
2002-10-02	RR	28	247	423	11.49	394.43	1.09	19697
20083								
2002-09-04	RR	33	33	230	6.29	216.00	1.09	19487
19697								
2002-08-02	RR	31	19	155	4.27	146.67	1.10	19346
19487								
2002-07-02	RR	28	130	261	7.13	244.67	1.10	19110
19346								
2002-06-04	RR	34	426	445	12.08	414.76	1.10	18706
19110								
2002-05-01	RR	28	518	473	12.83	440.64	1.10	18276
18706								
2002-04-03	RR	28	817	769	20.80	714.28	1.10	17577
18276								
2002-03-06		30		911	24.63	845.56	1.10	16747
17577								
2002-02-04		33		1027	27.75	952.79	1.10	15813
16747								
2002-01-02		33		1079	29.15	1000.86	1.10	14833
15813								

2001-11-30	32	812	21.96	754.03	1.10	14093
14833						
2001-10-29	28	567	15.37	527.55	1.10	13576
14093						
2001-10-01	27	313	8.53	292.74	1.10	13291
13576						
2001-09-04	34	231	5.86	201.20	1.10	13082
13291						
2001-08-01	33	202	5.01	172.13	1.10	12898
13082						

FUEL CHARACTERISTICS

To: Bitter Root RC&D Area, Inc.
1709 N. First Street
Hamilton, MT 59840
(406) 363-1444 Ext.#5
FAX: 406-363-5011
EMAIL: bitterrootrcd@bitterrootrcd.org
c/o Tom Coston

From: Richard L. Folk, Assistant Professor
University of Idaho, College of Natural Resources
Department of Forest Products
Moscow, ID 83844-1132

Subject: **Wood Fuels Characterization**

A. Ultimate Analysis (This analysis provides the percentage by weight, dry basis, of the elements in wood such as carbon, hydrogen, nitrogen, sulfur, oxygen, other non-combustibles known as ash. Might be important from an air quality/regulatory point-of-view. The HHV or higher heat value is the total heat generated by complete combustion under controlled conditions. The available potential heat, less than the HHV, at any moisture content is called the gross heat value (GHV) and can be calculated as follows: GHV = HHV x [1 - %MC (wet basis)/100]. The recoverable or useable heat energy is even less than HHV or the GHV since it contains heat losses associated with vaporizing water, the combustion of hydrogen gas, and heat loss in the stack gases).

	C	H	N	S	O	Ash	HHV(BTU)
Douglas-fir: Wood	52.3 52.5	6.3 5.8	0.1 0.1	0.0 0.1	40.5 41.2	0.8 0.3	9050 8730
Douglas-fir: Bark	56.2 53.0	5.9 6.0	0.0 0.0	0.0 trace	36.7 39.0	1.2 2.0	9570 9800
Ponderosa: Pine Wood	51.8	6.3	0.1	0.0	41.3	0.5	9130 9100
Ponderosa: Pine Bark	52.3	5.8	0.2	0.0	38.8	2.9	8780 9030 9100
W. Hemlock: Wood	50.4 50.1	5.8 5.9	0.1 0.1	0.1 0.1	41.4 42.2	2.2 1.6	8620 8290 8400
W. Hemlock: Bark	53.7	5.7	0.0	0.03	38.9	1.7	9400 9090
White Pine: Wood	52.6	6.1	0.0	0.0	41.3	0.1	8900
W. Redcedar: Wood							9700
W. Redcedar: Bark	51.0	5.7	0.0	trace	38.2	5.1	8610

Grand Fir: Wood	49.0	6.0	0.1	0.0	44.8	0.2	8200
Grand Fir: Bark	52.2	5.8	0.0	trace	40.3	1.7	8810
W. Spruce:	51.8	5.7	0.0	0.1	38.6	3.8	8740

B. Proximate Analysis (This analysis provides information about the percent of weight, dry basis, for the volatile matter, fixed carbon and ash. This might be important for energy production or "energy richness" of the wood and the amount of ash or non-combustibles which will require disposal).

	Volatile Matter	Fixed Carbon	Ash
Douglas-fir Wood:	86.2	13.7	0.1
	82.0	17.2	0.8
	82.2	17.5	0.3
Douglas-fir Bark	70.6	27.2	2.2
	72.9	25.9	1.3
Ponderosa Pine Wood	87.0	12.8	0.2
	79.4	20.1	0.5
Ponderosa Pine Bark	73.4	25.9	0.7
W. Hemlock Wood	84.8	15.0	0.2
W. Hemlock Bark	74.3	24.0	1.7
	74.2	23.6	2.2
	78.9	19.5	1.6
	72.5	25.8	1.7
Grand Fir Wood	84.4	15.1	0.5
	83.2	16.6	0.3
Grand Fir Bark	73.4	24.0	2.6
	74.3	24.0	1.7
W. Red Cedar Wood	86.7	13.1	0.2
W. Red Cedar Bark	73.0	21.9	5.1
	77.0	21.0	2.0
Lodgepole Pine Bark	73.5	26.0	0.5
W. Spruce Bark	69.6	26.6	3.8

C. Bark Ash Composition (This analysis provides information about the mineral composition of the ash which might be important from a landfill disposal, land application, slagging, and boiler corrosion point-of view).

	CaO	P2O5	Na2O	MgO	Fe2O3	SiO2	K2O	SO3	Cl
Douglas-fir	51.4	n/a	5.3	3.2	4.4	13.9	n/a	2.9	0.4
W. Redcedar	13.9	n/a	6.6	3.1	7.2	44.0	n/a	3.1	0.7
Lodgepole Pine	48.0	n/a	8.4	1.8	5.6	12.2	n/a	3.3	0.4
Grand Fir	60.8	n/a	10.4	3.0	3.2	1.7	n/a	3.0	0.4
W. Hemlock	58.2	n/a	9.1	4.4	3.6	1.5	n/a	3.7	1.4
W. Spruce	25.3	n/a	10.4	4.1	6.4	32.0	n/a	2.1	trace

D. Wood Density (This analysis provides information about the weight per unit volume (pounds per cubic foot) of wood when dry (0% MC), when green (saturated), or at some specified moisture content (10-15% MC).

	Specific gravity			Density lbs./cubic foot)		
	Dry	@ a specified MC	Green	Dry	@ a specified MC	Green
Douglas-fir (Interior West)	0.50	0.51 (13%) 0.49 (8%)	0.45 0.48	31.2	31.8 (13%) 30.8 (8%)	28.1 30.0
Ponderosa Pine	0.40	0.43 (11%) 0.44 (8%)	0.38	25.0	26.8 (11%) 27.5 (8%)	23.7
Lodgepole Pine	0.41	0.45 (8%)	0.38	25.6	28.2 (8%)	23.7
W. Hemlock	0.45	0.41 (12%) 0.46 (8%)	0.42 0.38	28.1	25.6 (12%) 28.7 (8%)	26.2 23.7
Grand Fir	0.37	0.38 (13%) 0.44 (8%)	0.35 0.36	23.1	23.7 (13%) 27.3 (8%)	21.8 22.5
W. Spruce	0.35	0.35 (12%) 0.38 (8%)	0.33 0.34	21.8	21.8 (12%) 23.2 (8%)	20.6 21.2
White Pine	0.38	0.43 (8%)	0.35	23.7	27.1 (8%)	21.8
W. Redcedar	0.32	0.33 (9%) 0.36 (8%0	0.31	20.0	20.6 (9%) 22.4 (8%)	19.3
W. Larch	0.52	0.55 (12%) 0.61 (8%)	0.48 0.51	32.4	34.3 (12%) 38.2 (8%)	30.0 31.8
Subalpine Fir	0.32	0.34 (8%)	0.31	20.0	21.3 (8%)	19.3

E. Moisture Content of Green Wood (This analysis provides information about the percent moisture content [dry basis and wet basis] of green wood [saturated] in the heartwood and sapwood regions of the tree. %MC [wet basis] = (%MC [dry basis] /(1 + %MC [dry basis])) x 100

	%Dry Basis		%Wet Basis	
	Heartwood	Sapwood	Heartwood	Sapwood
Douglas-fir	37	115	27	54
Ponderosa Pine	40	148	29	60
W. Hemlock	85	170	46	63
Lodgepole Pine	41	120	29	55
White Pine	62	148	38	60
Grand Fir	91	136	48	58
W. Spruce	51	173	34	63
W. Larch	54	110	35	52
W. Redcedar	58	249	37	71

F. Discussion & Conclusions

The fuel characteristics of wood will vary within species due to age of the tree (small-diameter old growth vs small-diameter young trees), geographic location (latitude and longitude), aspect (north, south, east , or west facing slopes), elevation, and inheritance. These can be very difficult to accommodate in an analysis or model so it is best to use average values. I have given multiple values for some characteristics due to different numbers being recorded by different researchers and due to the variables mentioned above. Each number is an average of all the data taken from that particular study. You may therefore want to select one of the multiple values or specify a range from the lowest to the highest of the values.

In the case of "fire-damaged pulp" trees, the bark is certain to be absent or unuseable. Moisture content of the standing tree or wood from salvage will not likely be above 30%, dry basis (23%, wet basis) so wood density values will be less than dry values but greater than green since green values represent saturation above 30%. Following is some additional information on the weight per cubic foot for selected species of logs. These values are usually important for log truckers who use cubic scale of the logs to determine legal loads.

Western redcedar	27 lbs./cubic foot
Douglas-fir (inland)	48 "
White fir/Grand fir	47 "
Western Hemlock	41 "
Western larch	48 "
Lodgepole pine	39 "
Ponderosa pine	45 "
Western white pine	35 "

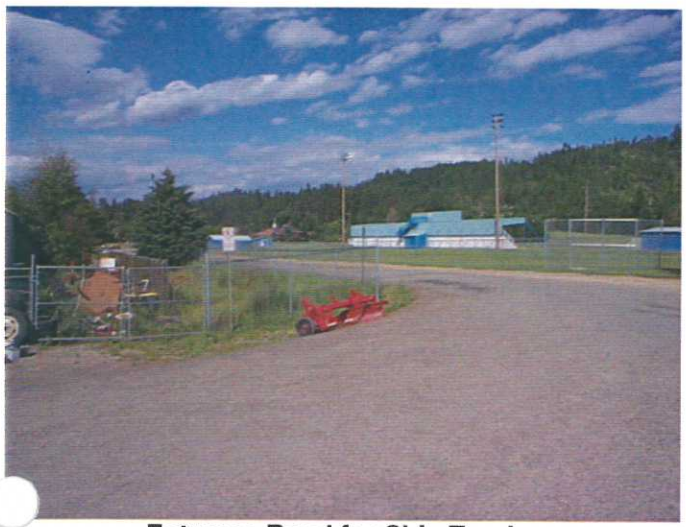
PHOTOS

Proposed Heating Plant Site – View 1

Proposed Heating Plant Site – View 2

Proposed Heating Plant Site – View 3

Proposed Heating Plant Site – View 4



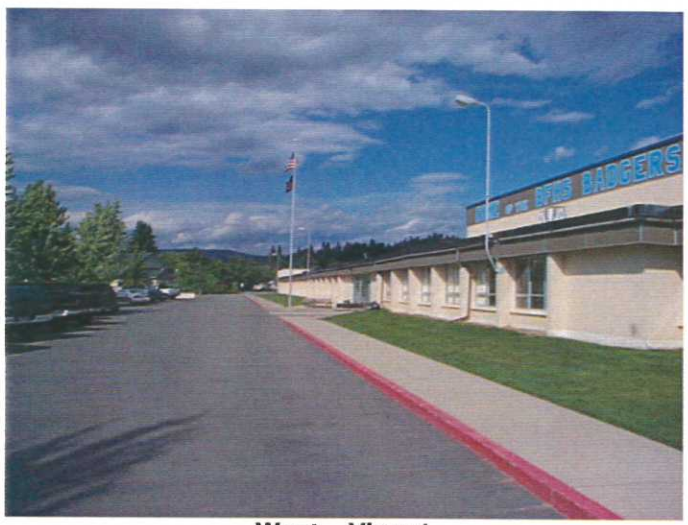
Entrance Road for Chip Trucks

Truck Access to Chip Storage

South - View 1

Shop Building

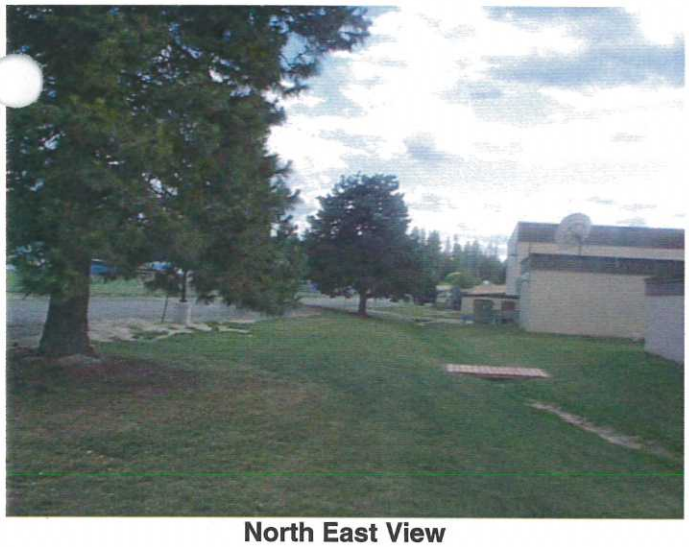
South East Interior of Shop.
Possible Pump Location



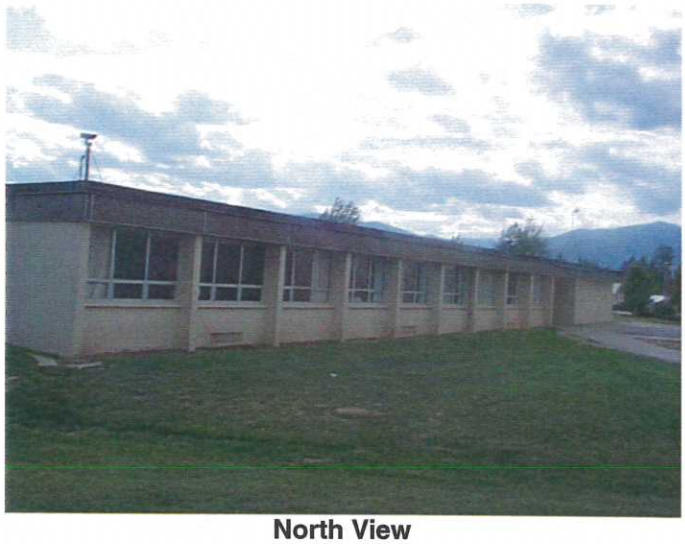
West – View 1

Band Building

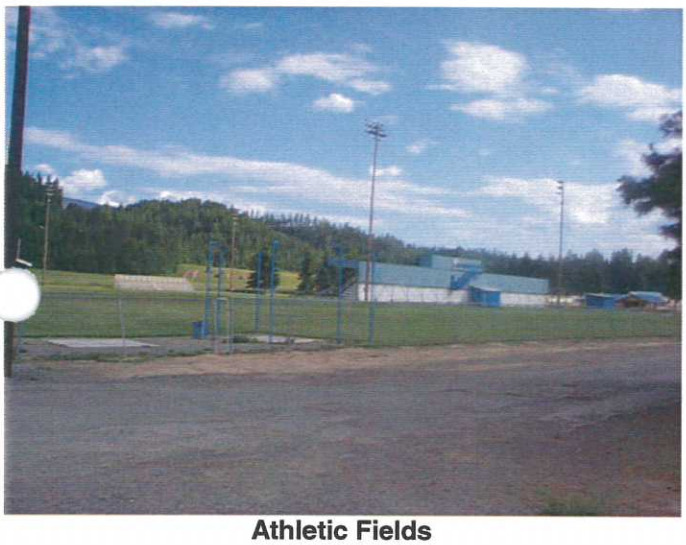
East – View 1



North East View



North View



Athletic Fields

East Shop Entrance

BIOMASS INFORMATION

A Biomass Systems Primer

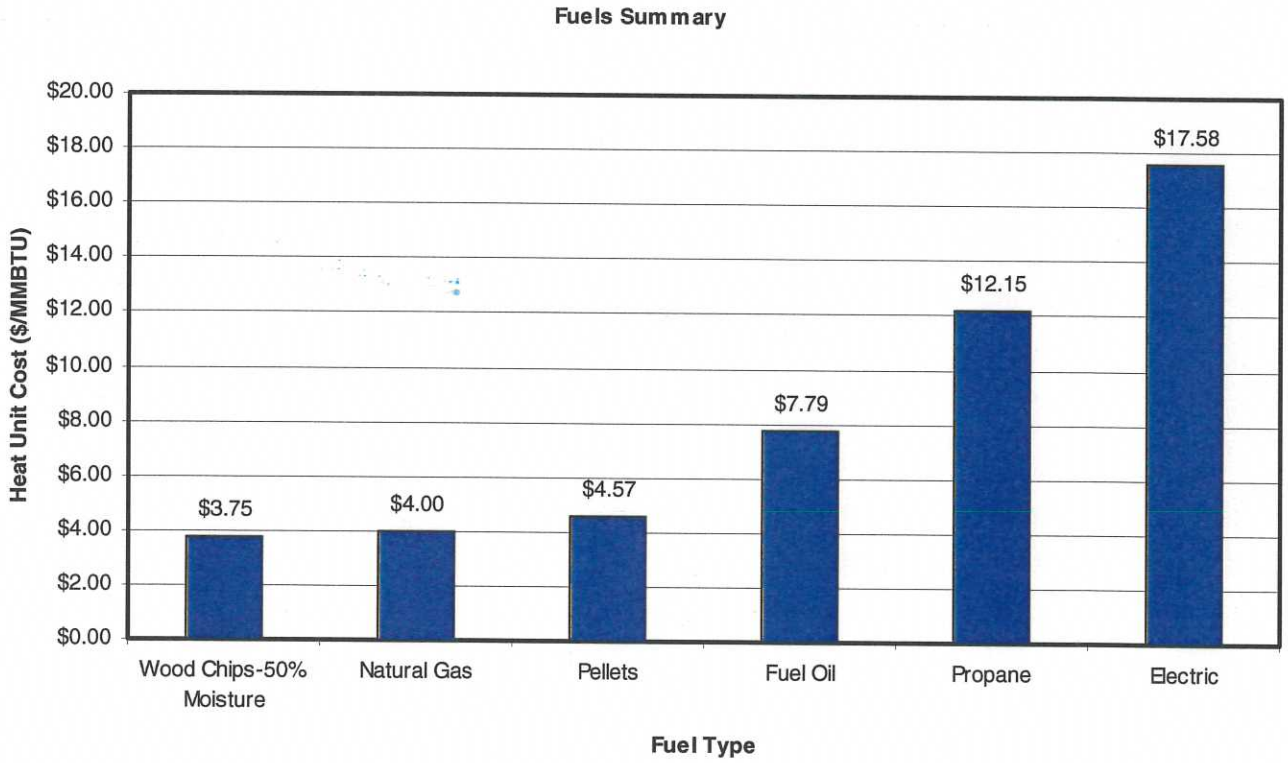
The primary objectives of the Fuels for Schools Initiative are to:

- **Develop markets** for non-merchantable wood byproduct of Comprehensive Forest Treatment - *Provide a vertically integrated solution to Forest Health and Wild Fire Risk.*
- **Partner with Communities** to integrate treatment benefits into local society.
- **Develop practical, cost effective application models** for integrating biomass-heating systems into systems representative of a larger application group.
- **Identify criteria** and an evaluation technique to form an entry niche application strategy.

Benefits and Considerations for Biomass Energy

Biomass energy comes with a variety of benefits and considerations. The following are among the many benefits of biomass systems:

- Wood fuel has better cost stability than conventional fuels. Compared to petroleum based and natural gas fuels, wood based fuels have lower cost escalation and volatility.
- Although local factors vary, wood fuel typically costs less than conventional fuels. A cost comparison of wood based fuels to other common fuels is provided in the below chart and table. Note these comparisons do not figure in recent natural gas increases.
- Local fuel production adds to the economic base of our already struggling timber towns.
- Biomass energy directly integrates with efforts to improve forest health.
- When approached in a sustainable manner, biomass energy is a renewable energy source.
- Depending on the fuel production methods, the net carbon emissions to the atmosphere are near zero. The carbon released from the combustion of biomass material is already in the present carbon cycle, as opposed to coal or oil based carbon, which is reintroduced to the carbon cycle after millions of years of sequestration.



Fuel Type	Heating Value (BTU)	2003 Cost ($)	Heat Unit Cost ($/MMBTU)
Wood Chips-50% Moisture	4000 btu/pound	30/ton	$ 3.75
Natural Gas	900 btu/standard cubic foot	4/MMbtu	$ 4.00
Pellets	8200 btu/pound	75/ton	$ 4.57
Fuel Oil	140,000 btu/gallon	1.09/gallon	$ 7.79
Propane	90,502 btu/gallon	1.1/gallon	$12.15
Electric	3413 btu/kwh	0.06/kwh	$17.58

Some special considerations need to be taken into account when considering a Biomass Energy program (multiple projects in an area) or a single Biomass Project:

Some Basic Biomass Program Considerations:

- Is there a significant, sustainable need for Forest Treatment?
- Is there existing timber industry able to process and deliver the wood fuel?
- What is the potential market within a reasonable haul range?
- Are there Commercial and Institution buildings that may benefit from biomass system energy cost savings?
- What conventional fuel sources are available, and what is their relative cost?
- What is the local enthusiasm?
- Local ability to consider new ideas.

Biomass Heating Technologies

The technologies available to produce automated heating energy from wood based biomass are varied in their approach, but largely can be separated into two types of heating plant; wood chip and pellet fueled. Manufacturers of both system types were contacted for assistance with this assessment. Particular acknowledgement should

be paid to Messersmith Manufacturing, King Coal Furnace Corporation, and Solagen Incorporated for their assistance in developing concepts, costs, and project models.

Wood Chip System Summary

Two types of wood chip boiler plants were considered for this assessment.

The first concept is developed with an on-grade chip storage method instead of the below-grade systems used in Darby and typical of systems in the New England. The system is housed in a building of slab on grade construction. Chips would be unloaded from a live floor van onto the storage floor as the van pulls slowly out from the space. A live auger would traverse the floor to dispense chips to the belt conveyance system on the opposite side of the bin wall. From the belt conveyor, the chips are transferred to a fuel metering bin and auger. The boiler room would be set two feet in elevation below the chip storage to allow for the conveyance equipment.

The second concept utilizes a prefabricated fuel storage bin and chip conveyance equipment and, up to 5MMBTUH capacity, a prefabricated boiler room. The chips are unloaded directly into the storage bin by backing the chip van into the bin and unloading the chips as the truck slowly pulls out. Chips are conveyed from the bin to a fuel metering conveyor (twin screw auger) by hydraulic floor wedges which gradually move the fuel supply into the auger and eventually the furnace. From the fuel-metering conveyor, the fuel moves through an air lock to the furnace stoker auger where it is delivered to the furnace for combustion. After the products of combustion leave the boiler, they pass through a multicone separator to remove suspended particulate. Schematics of this system type are available in the Biomass Information Appendix.

Independent of system type, wood chip systems have distinct advantages and disadvantages:

<u>Advantages of the green chip system:</u>

1. Readily available fuel sources, such as hazardous fuel reduction residue, could be integrated on site with the involvement of only a local treatment and chip supply contractor.

2. The technology would be more of a known quantity than others would after the Darby job is complete.

3. The installation is fully indoors, minimizing the aesthetic effect on the school and surroundings.

<u>Disadvantages of the green chip system:</u>

1. In some sizes the initial capital cost of these systems is high compared to pellet systems.

2. The quality, moisture content, heating value, and consistency of chip fuel can be highly variable.

3. Depending on this fuel quality, the material conveyance portion of this system is susceptible to disruptions.

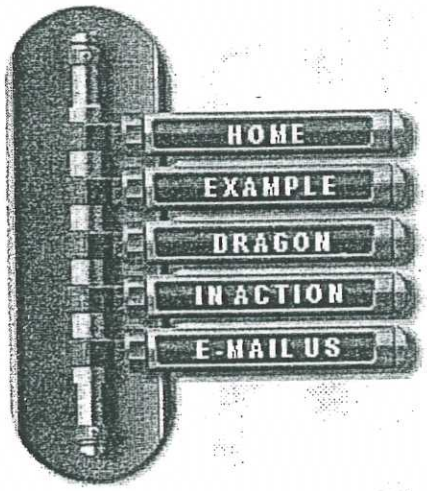
The sizes of the green chip storage, material handling, and boiler are large. This requires additional building be built, further increasing an already high capital cost.

MESSERSMITH MANUFACTURING INFORMATION

Messersmith

Industrial Conversion Combustion Systems

Messersmith Manufacturing, Inc.
2612 F Road
Bark River, MI. 49807
906-466-9010
Fax 906-466-2843
sales@burnchips.com



THE COST SAVING MESSERSMITH COMBUSTION SYSTEM

The Messersmith Institutional and Industrial Combustion System

- **Hopper sized according to your needs and limitations.**
- **Factory installed on your site.**
- **Firing wood chips, sawdust, or other particle biomass fuels.**
- **Burn clean and efficient.**
- **Heating outputs from 1,000,000 to 20,000,000 B.T.U.H.**
- **Converts many boilers and furnaces.**

The Messersmith system takes you one step beyond the traditional woodburning stove.

An automatic BIOMASS fuel system custom designed for the unique needs of your location.

Is designed to minimize overall operating costs. Wood fueled heating systems are expensive, and this expense must be balanced by the savings that these systems can produce in the long term. Our system is designed to lower operating costs in the following ways:

- Relatively Low First Cost
- Simplicity of Maintenance and Repair
- High Fuel Efficiency and Versatility in the Fuel Choice
- Low Electrical Energy Consumption

Please allow us to explain briefly how our system achieves these results

these results.

Relatively Low First Cost

Messersmith Systems are usually priced below those offered by competing manufacturers. This is because our systems are as simple as possible, without sacrificing reliability, performance, or safety. Unique features of the Messersmith system that contribute to its low first cost are the traveling auger bin unloader and direct combustion burner. The traveling auger eliminates the need for costly hydraulic system, required with wedge floor unloading systems, and reduces bin construction cost. The direct combustion burner operates to atmospheric pressure, avoiding the cost of rotary air locks and induced draft fans used in gasifier-based systems.

Simplicity of Maintenance and Repair

The Messersmith System is designed and built to be reliable and easy to maintain and repair. Most of the mechanical and electrical components of our system are obtainable directly from W.W. Grainger, which has nation-wide distribution, usually on a next day basis. The Messersmith System is simple; therefore, maintenance and repairs can be easily and quickly carried out. Often maintenance personnel become so familiar with our systems during the warranty period that there is practically no need for subsequent professional servicing.

High Fuel Efficiency and Versatility in Fuel Choice

The Messersmith System is very efficient and clean burning. Larger Messersmith Systems provide modulated fuel and air supply to the combustor, providing the correct ration and placement of fuel and air for efficient, smoke free combustion over the full range of heat output. Automatic flue cleaning systems are a standard feature of our systems, maintaining maximum transfer of heat to the boiler with no operator attention. While the use of natural draft from a properly sized (larger) chimney enables our system to minimize its electrical consumption, we can also supply a cyclone ash separator to minimize ash emissions from the stack.

Messersmith Systems perform more reliably than many other wood chip systems when burning whole

tree chips. Its reliability is directly attributable to the simplicity of the fuel flow path to the boiler, including the absence of rotary air locks. Its reliability has recently been further improved by the use of conveyor belts instead of augers to move fuel from the chip storage bin to the metering bin. Conveyor belts are not susceptible to jamming from oversized chips, use less electric power, and are quieter than augers. The ability to burn whole tree chips is an advantage of the Messersmith System that is apt to get more important with time as the demand for high quality mill residue chips will eventually exceed the supply.

Low Electrical Energy Consumption

The Messersmith System is remarkably efficient in its use of electricity. When operated under natural draft, the electricity use of a 1 to 5 million BTU Messersmith System averages from one to two kilowatts. Its high electrical efficiency is due to the small number and size of electric motors employed. The largest motor on a natural draft system is the hopper auger motor, which is only 1.5 hp on the 1.5 million BTU system, and operates less than one hour per day under average winter conditions. A natural draft Messersmith System can be expected to consume less than one fourth of the electricity of a typical gasifier based system with induced draft fan. While an induced draft Messersmith with cyclone ash removal will consume about half of the electrical energy of a gasifier-based wedge floor system.

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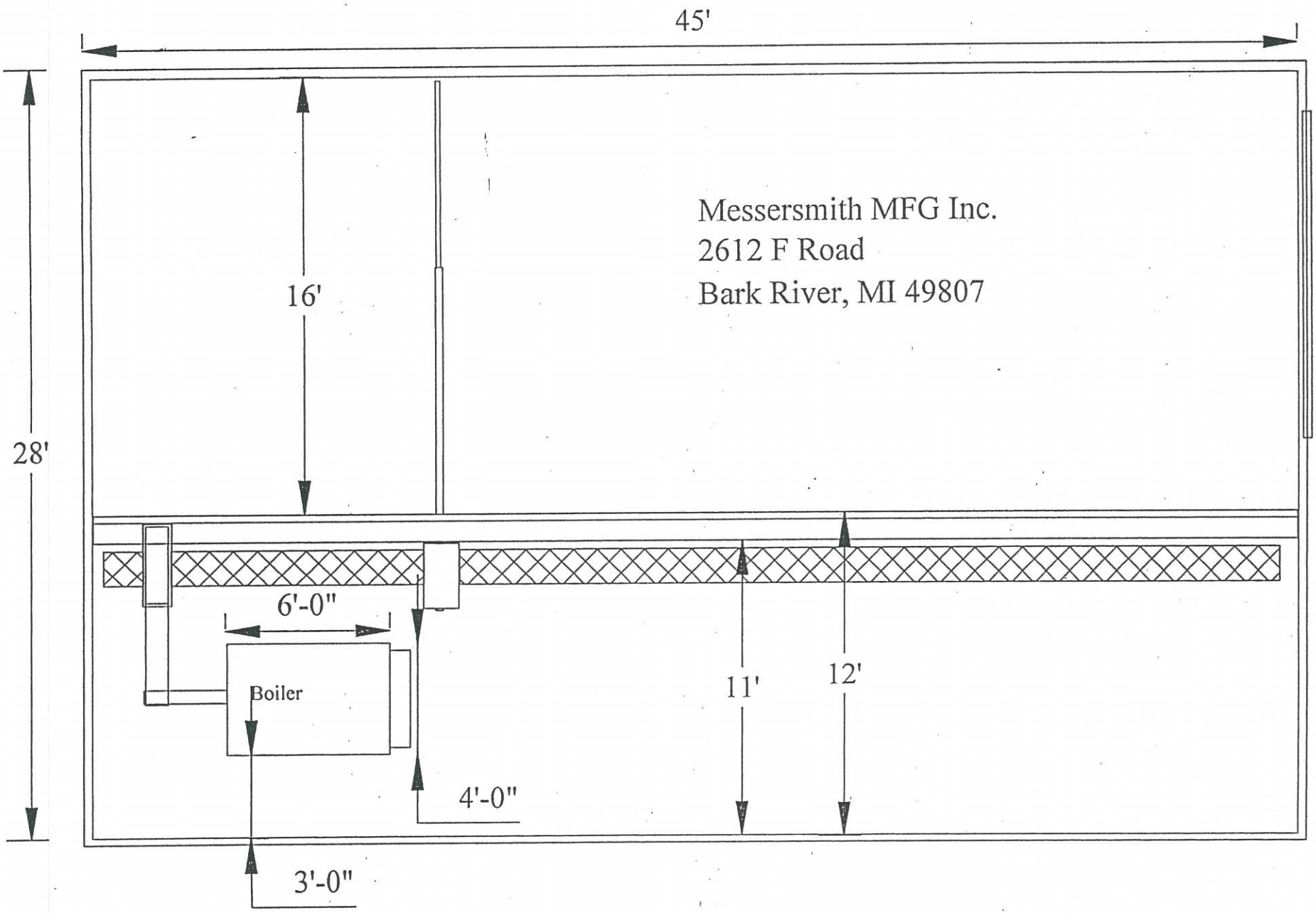
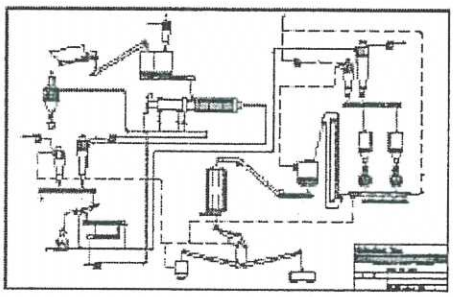

45'
28'
16'
Messersmith MFG Inc.
2612 F Road
Bark River, MI 49807
6'-0"
Boiler
11'
12'
4'-0"
3'-0"

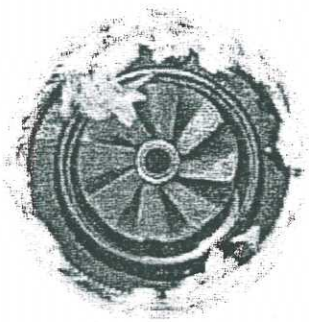
SOLAGEN INCORPORATED INFORMATION

We appreciate this opportunity to introduce you to
SolaGen Incorporated.

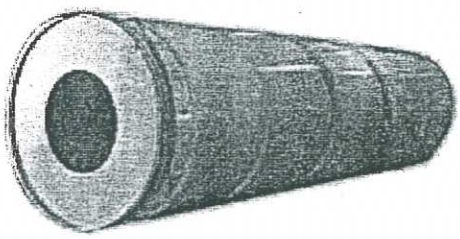
We are a multi-disciplined company specializing in Heat Generating Burner Systems, Process Design Engineering, Manufacturing, and Field Consulting Services. We have exceptionally high success levels providing products and services to the forest products, chemical, energy generation, dehydration, marine, and heavy equipment manufacturing industries. Our high experience levels assure that our customers receive the products and services they require in the competitive markets of today.

-- Process Engineering --



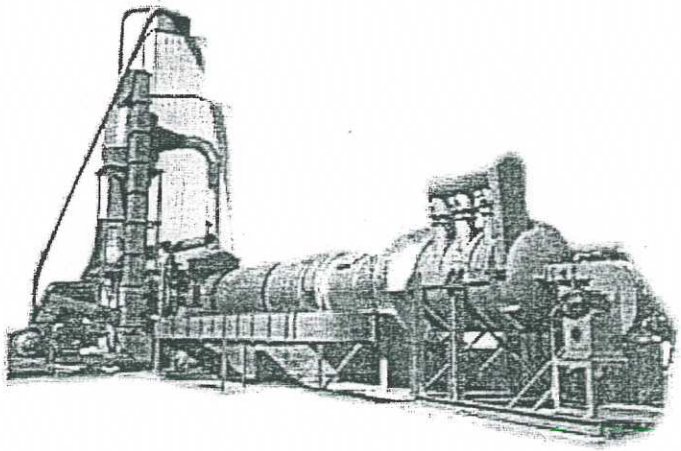


-- Product Lines --

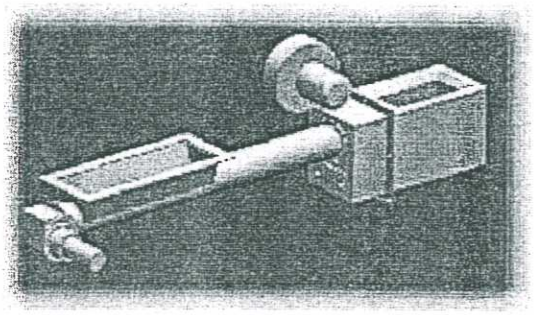


-- Field Services --

-- Project Types --



NEW PRODUCT LINE INTRODUCTION!



SolaGen Incorporated introduces the new HDF-LI Stoker.

This unit is ideal for shelled corn and biomass pellets under commercial and light industrial applications. Its performance is unsurpassed in its ability to handle high ash content fuels with low ash fusion temperatures. The product line starts with the HDF-LI-0.5 that has a maximum input rating of up to 500,000 Btu/Hr. The stoker can be assembled as a complete system with Bulk Fuel Infeed, Firebox, PLC Controls, Hot Water or Steam Boiler, or Process Heat Exchanger.

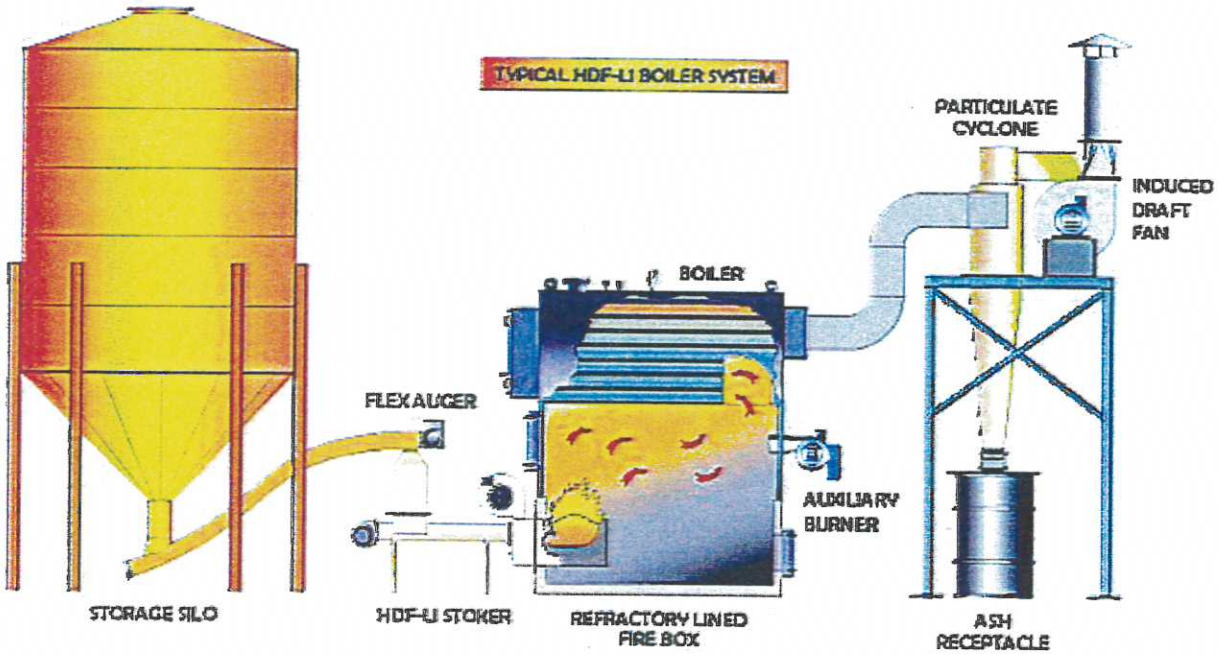
For more information call 503-366-4210, Fax 503-366-4215, or Email solagen@solageninc.com

SolaGen Incorporated introduces the new line of HDF-LI Stokers and related support components.

This product line is designed to offer economical solutions for the generation of process heat, hot water, or steam. The unique stoker has undergone extensive research and development to assure trouble-free operation with a variety of high-density fuels such as shelled corn and biomass pellets.

SolaGen Incorporated has for many years focused on the development and supply of large industrial energy systems for the power producing, forest industries, and pulp & paper markets. We have taken our in-depth experience and engineered this new equipment to service such applications as:

- Greenhouses
- Municipal buildings and warehouses
- Small factories and manufacturing facilities
- Swimming pools
- Schools



The HDF-LI Stoker is not designed as an oversized residential corn or wood pellet stove, but rather, as a truly "Light Industrial" energy process. The smallest stoker, our HDF-LI-0.5, has a maximum firing rate of up to 500,000 Btu/Hr. The complete HDF-LI process will contain modular components properly sized to assure our customers receive exactly what they need. Please contact us with your energy requirements, be it a simple system for building heat or for high-pressure steam. We are confident that an economical solution can be engineered for your process.

Product Line Features:

- Heavy duty construction for continuous operation
- In bed mechanical agitation for reduction of clinkers
- Circuit breaker and fused protection of motor drives
- Over and under temperature safeties
- Water deluge fire protection
- Industrial PLC control system
- Automated stoker fuel loading
- Factory calibration and checkout of components
- Can be configured as hot air furnace, water or steam boiler
- Optional auto ignition system

For more information call 503-366-4210, Fax 503-366-4215, or Email solagen@solageninc.com

KING COAL INFORMATION

King Coal Packaged Boiler Rooms With Fuel Storage

King Coal Furnace Corporation
PO Box 2161
Bismarck, ND 58502
Phone: 701-255-6406
Fax: 701-255-6916
E-Mail: kingcoal@btinet.net

KING COAL FURNACE CORPORATION

P.O. Box 2161
Bismarck, ND 58502
Phone: 701-255-6406 Fax: 701-255-6916 E-Mail: kingcoal@btinet.net

The King Coal prefab boiler room and fuel storage is the result of 23 years of knowledge gained by us in the wood and coal industry. King Coal has been building package boiler plants for schools, sawmills and kiln drying plants for years.

We have stoker fired boilers in Alaska, Canada, and North and South America.

The King Coal Advantage Is:

- Above ground operations- no ground water problems.
- The plant comes completely assembled, wired, plumbed, etc. Very minimal on site labor for assembly of fuel augers, ash removal, etc.
- No expensive construction required. Just a slab for boiler room and fuel storage, or only footings where permitted.
- Our stoker system will burn chips, sawdust and bark (50% moisture to dry) or wood pellets. All these fuels use the same equipment and fuel storage.
- We provide P.L.C./ V.F.D electronic control panels as standard equipment to provide maximum efficiency of combustion and proper turn down.
- Our prefab boiler plants are available from 50-250 HP, or to 500 HP with on site construction.
- Our stoker is a close coupled gasifier that sets under the boiler to take best advantage of radiant heat.

Wood fuel is augured up through a retort into a pile. The wood is pyrolyzed and the gas is combusted with secondary air. Its flame then enters the firebox of the boiler which is refractory lined, and includes an ignition arch for proper flame travel and retention time.

Primary and secondary combustion air is preheated for efficient and smokeless combustion.

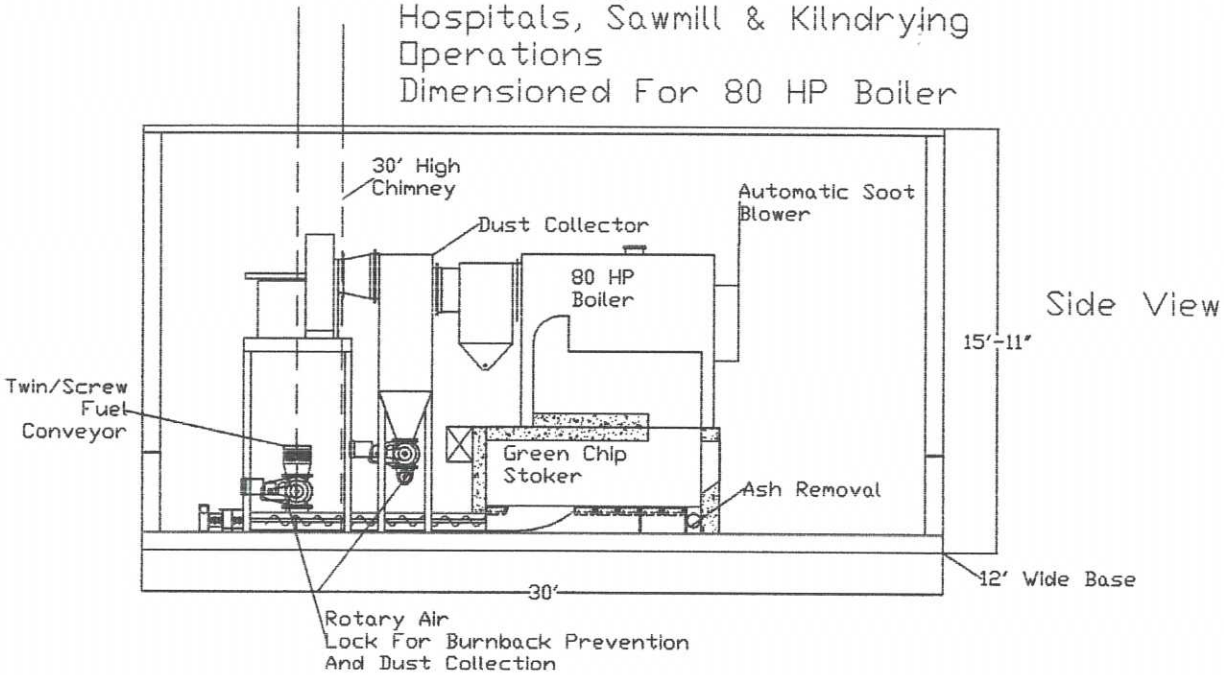
- Construction time to delivery for our package plants can be as short as 90 days from receipt of order. This may vary depending on the time of season and work backlog.

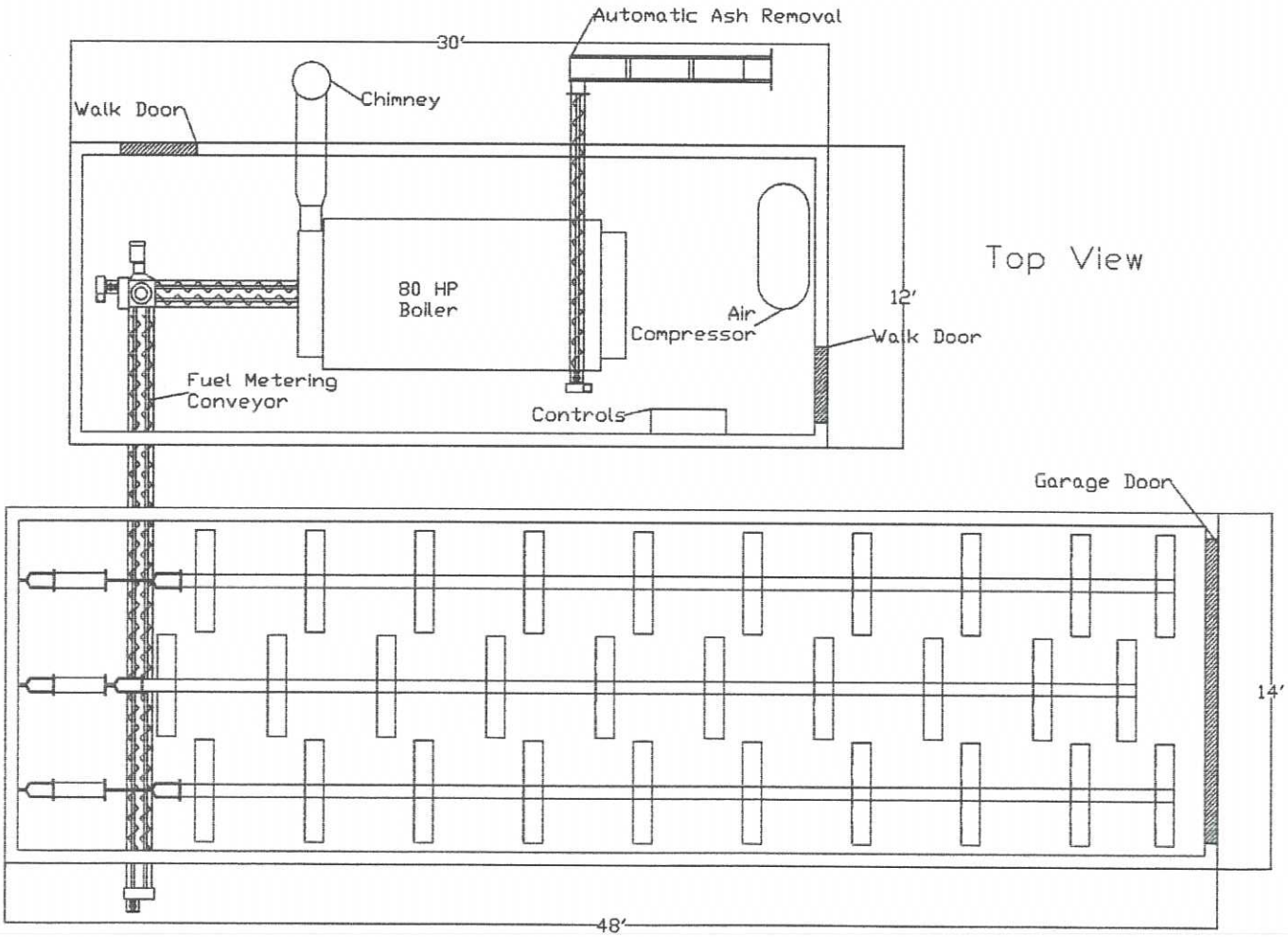
- All systems come with multi-cone dust collection. Our stoker is designed to burn the gas produced by the wood fuel. No suspension burning occurs, so very little particulate and char escapes the boiler. Fly ash that does escape is collected and sent to ash storage.
- All stokers are equipped with automatic ash removal, which consists of an in-base cross auger with integral incline drag chain conveyor.
- All boilers come equipped with soot blowers, eliminating the need for manual brushing of the tubes. The benefits are maximum heat absorption in the convective tube section of the boiler and no shut downs for manual cleaning.
- Our package boiler and fuel storage plants are your best value. No one can block and brick build a boiler room, wire, plumb, install controls on-site, plus the other work required to complete a project and come close to our price.
- King Coal offers one source responsibility, no excuses or reasons why it's some one else's problem.
- All plants come with a prefab, insulated chimney.
- Start-up procedures and operator training are included.
- We can also provide current low interest financing to qualified buyers.

Thank you for your time in reviewing this information. If you have a project that you feel could utilize our equipment, please notify us and we can discuss the details of your particular facility.

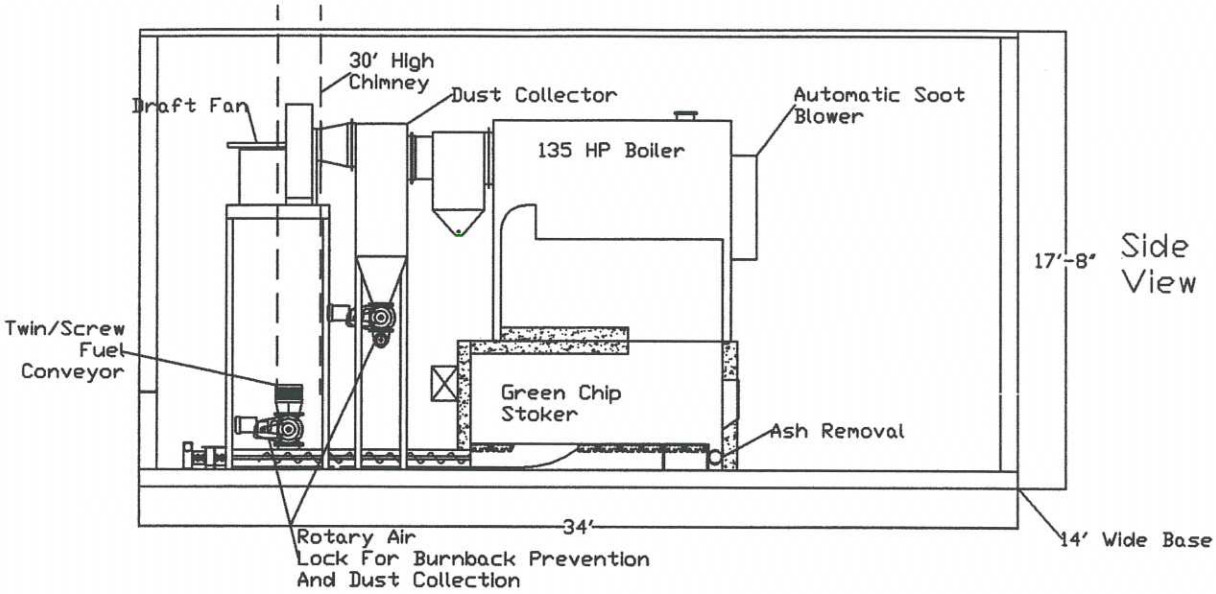
MICHAEL F. ROBB
President
King Coal Furnace Corporation

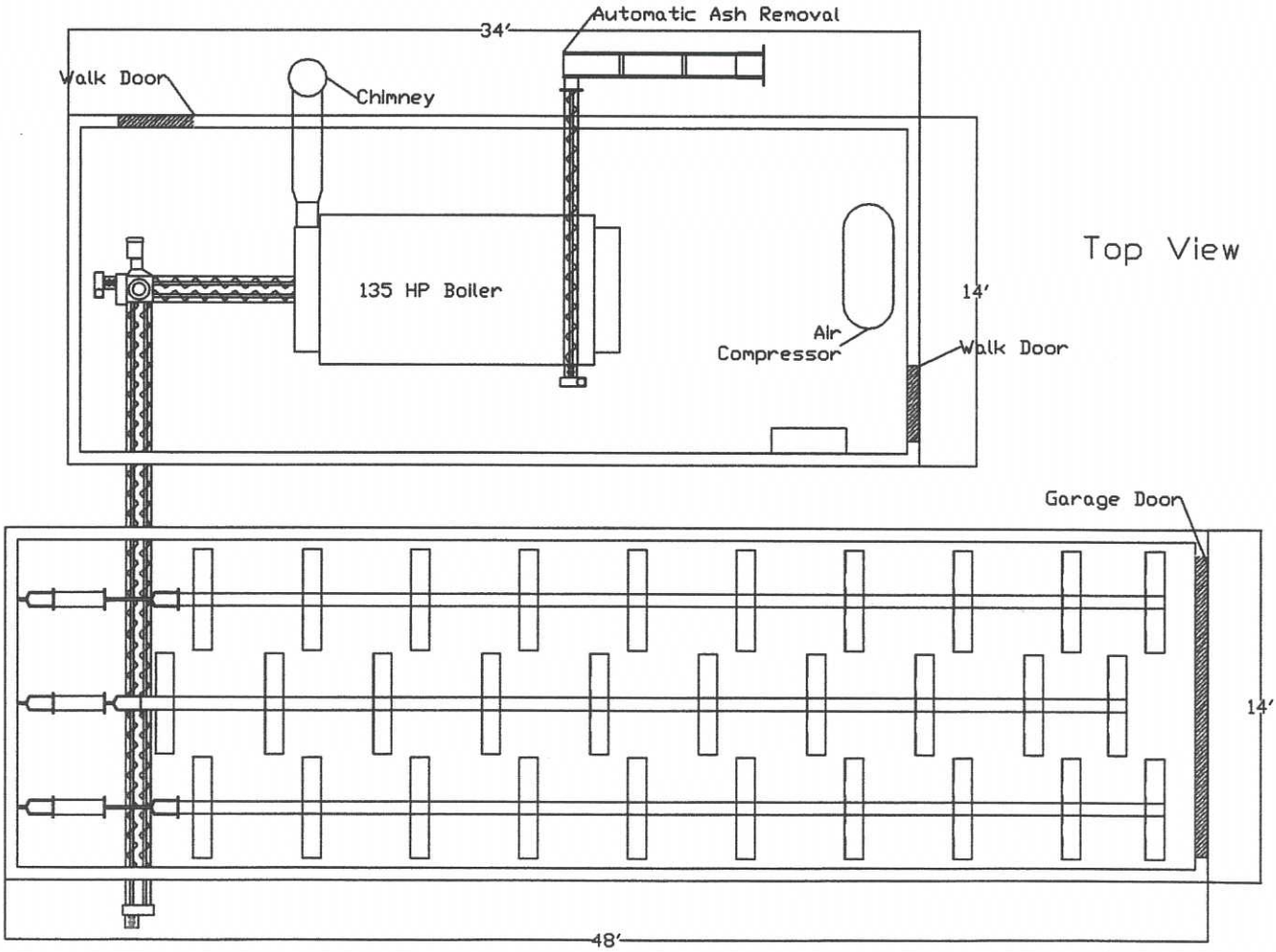
King Coal Package Boiler Room With Fuel Storage- For Schools, Hospitals, Sawmill & Kilndrying Operations Dimensioned For 80 HP Boiler



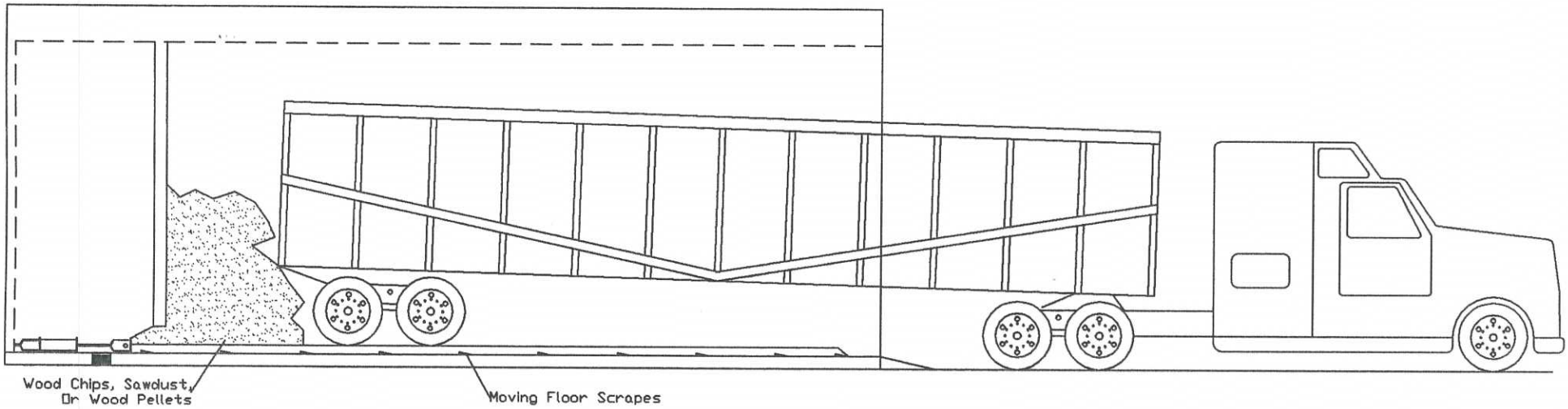


King Coal Package Boiler Room With Fuel Storage- For Schools, Hospitals, Sawmill & Kilndrying Operations
Dimensioned For 135 HP Boiler

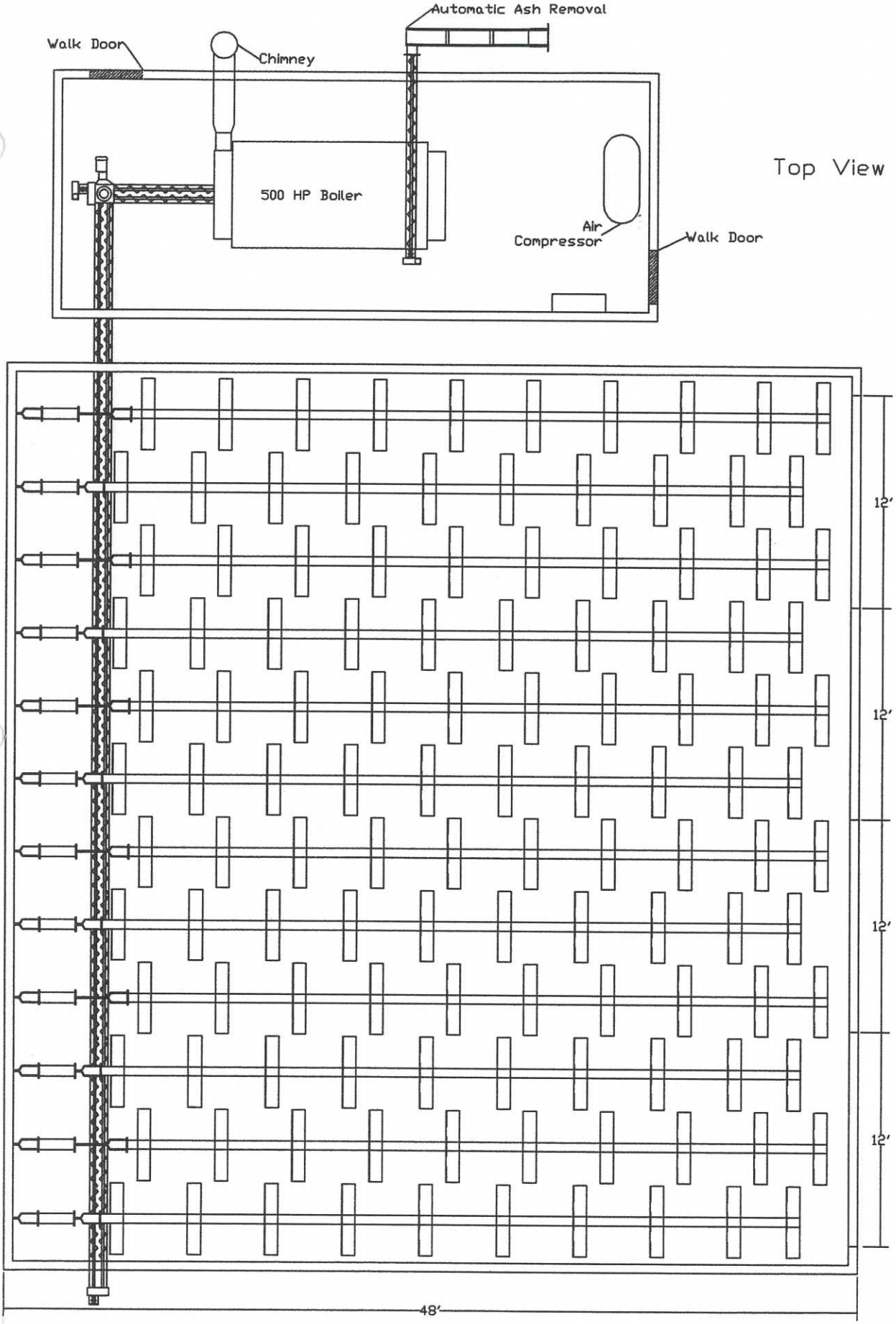




King Coal Floor Scrape Fuel Storage Prefab Building. These Storage Buildings Can Be Built 8'-10'-12'-14' Wide & 48' Long Or Can Be Ganged Together Side By Side For Greater Capacity.



The King Coal Advantage Is: You Can Back Your Fuel Delivery Truck On To The Floor Scrapes & Unload In The Building

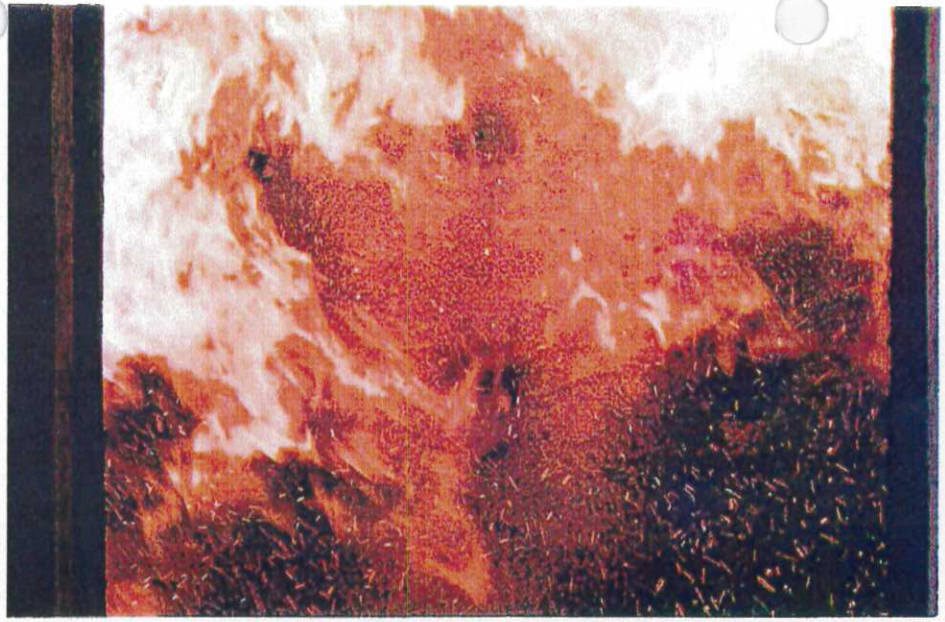


4 Of Our Modular 12' By 48' Floor Scrape's
Combined To Make a 48' By 48' Building

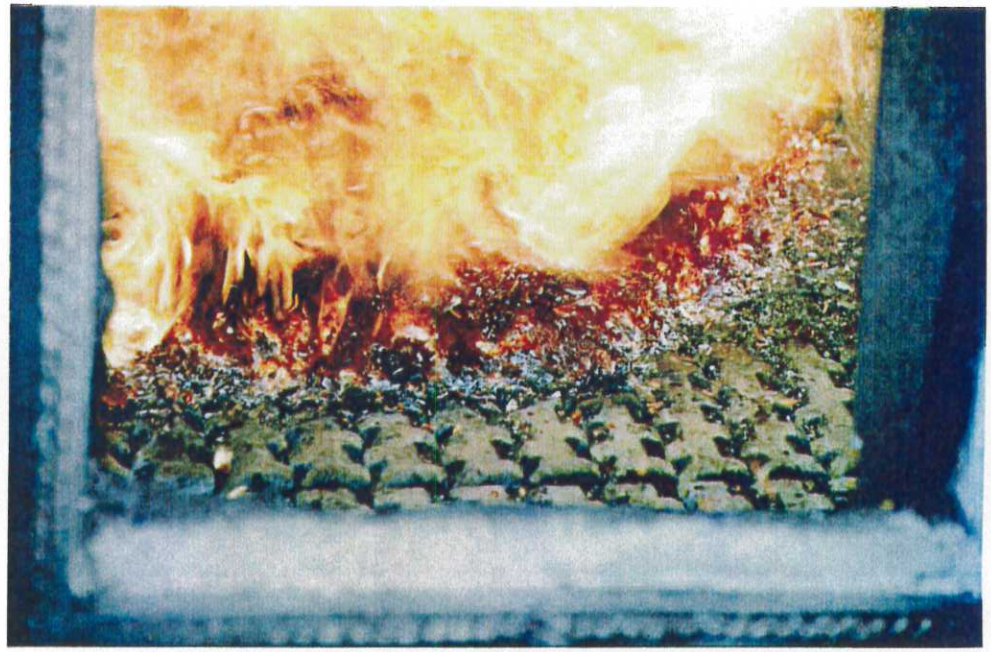
P.L.C. & VFD CONTROL PANEL

PORTABLE FLOOR SCRAPE FUEL STORAGE

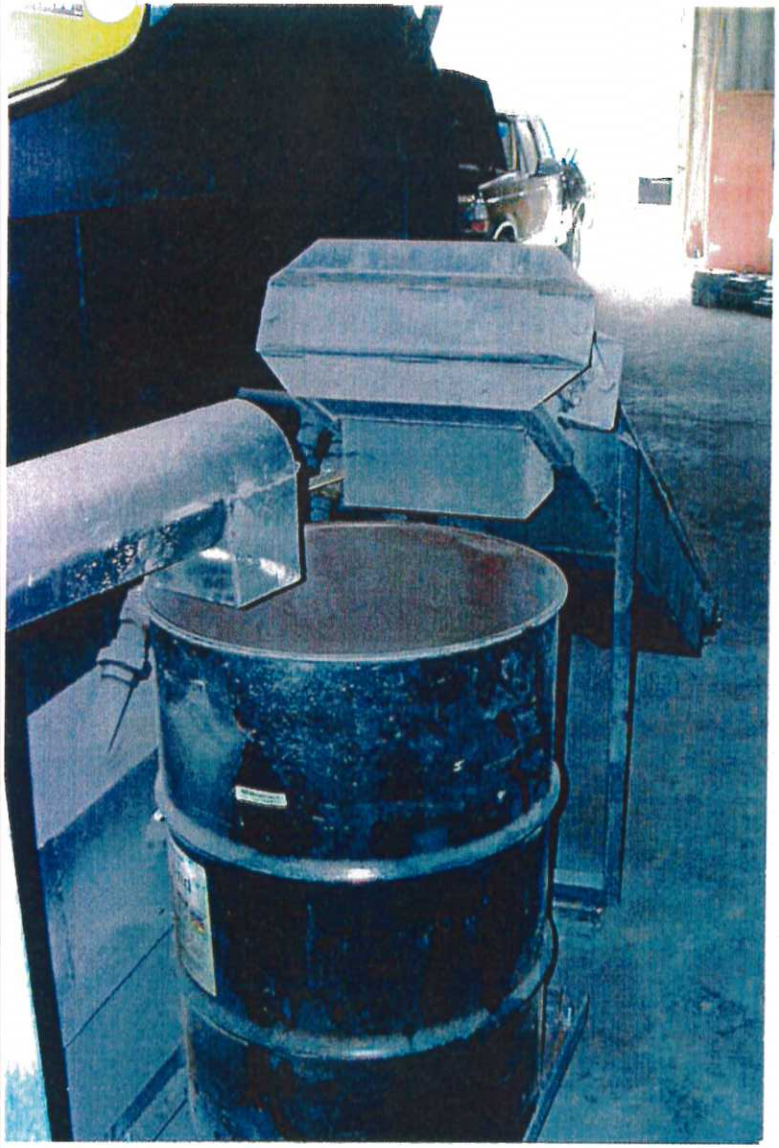
FUEL IS PULLED INTO CROSS AUGER
THEN FED TO BOILER



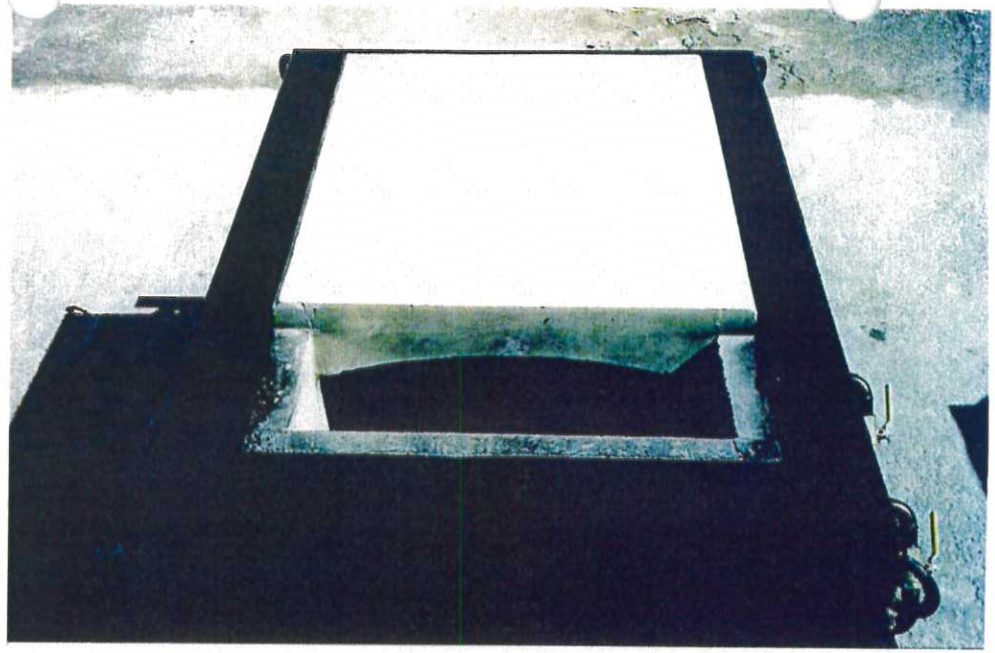
HYDRAULIC DRIVEN TWIN SCREW FUEL FEEDER



TYPICAL BURNER WITH OVER AND UNDER FIRE AIR
CROSS AUGER AND DRAG CHAIN ASH REMOVAL



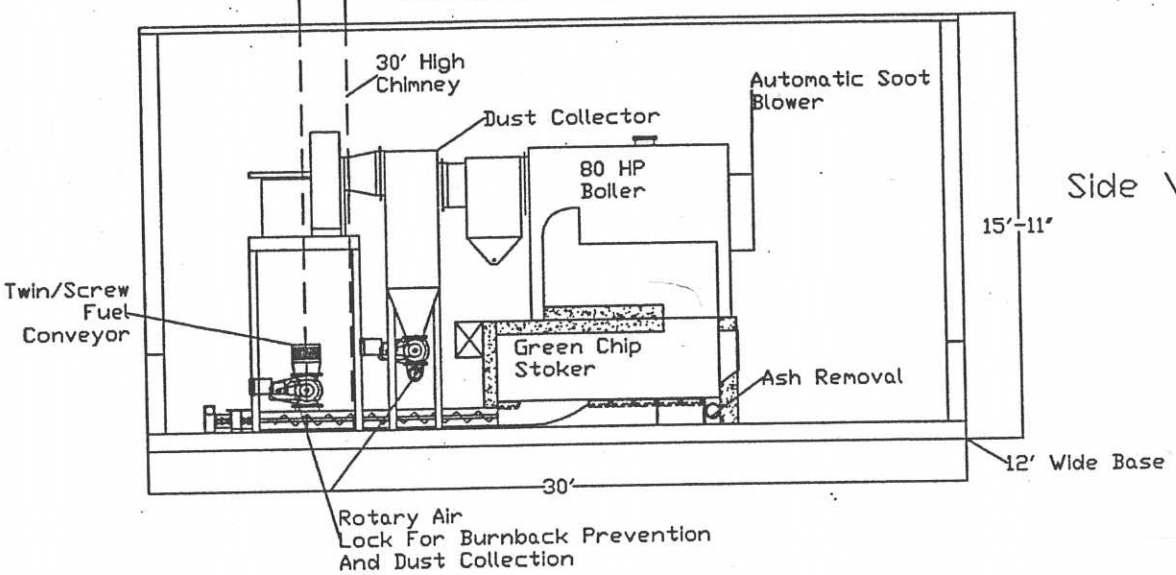
TYPICAL ASH REMOVAL FROM STOKER & FROM MULTICONE COLLECTION ON BOILER SMOKE BOX OR WE CAN SUPPLY AN OPTIONAL ASHWAGON

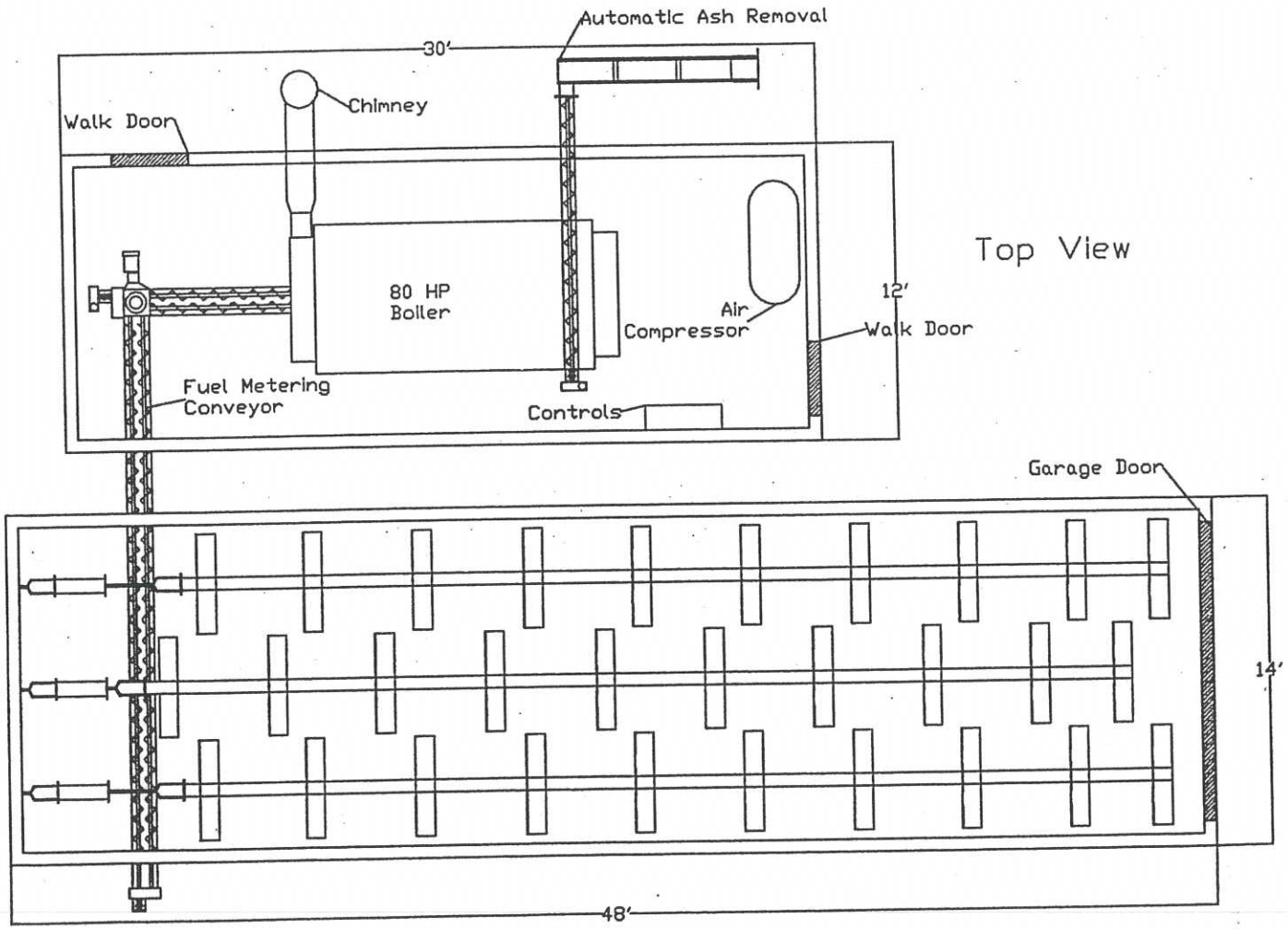


OUR COMBUSTION CHAMBER WITH TOP COMBUSTION ARCH

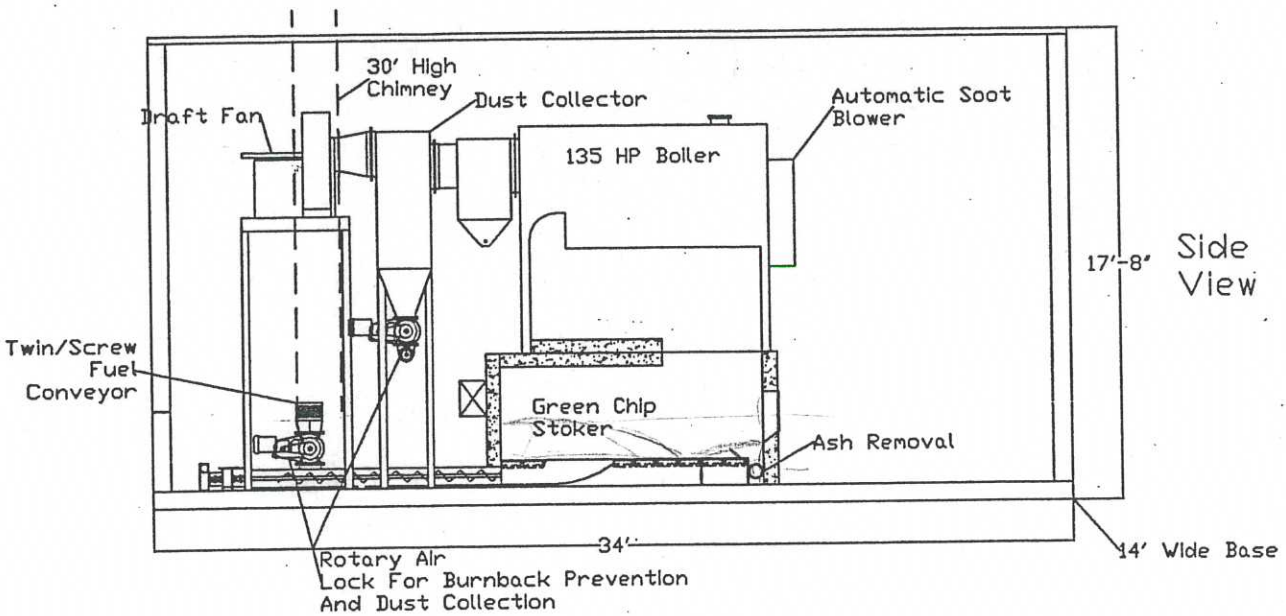
STOKER TUYERES, RETORT & OVER FIRE AIR JETS

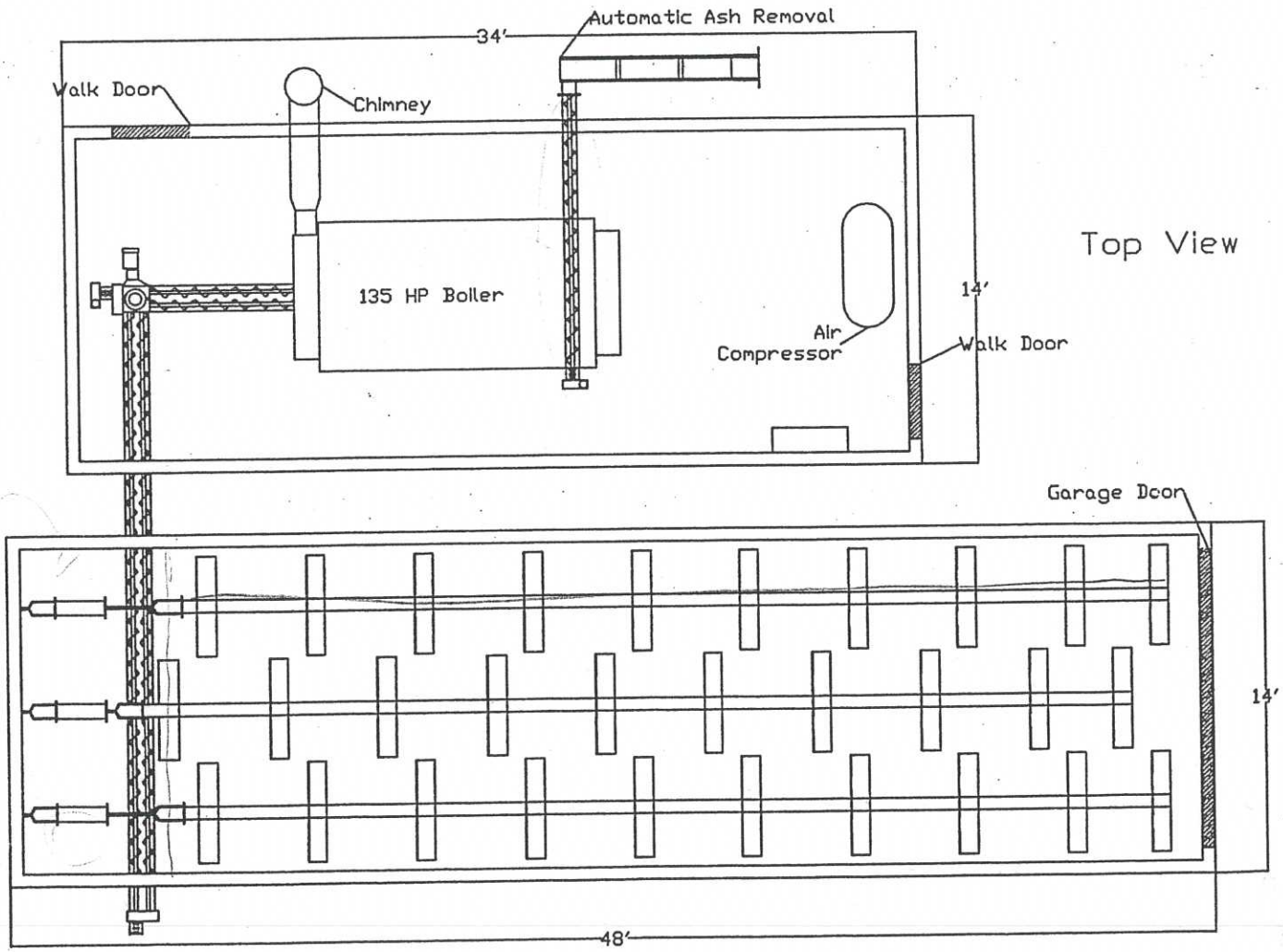
King Coal Package Boiler Room With Fuel Storage- For Schools, Hospitals, Sawmill & Kilndrying Operations
Dimensioned For 80 HP Boiler



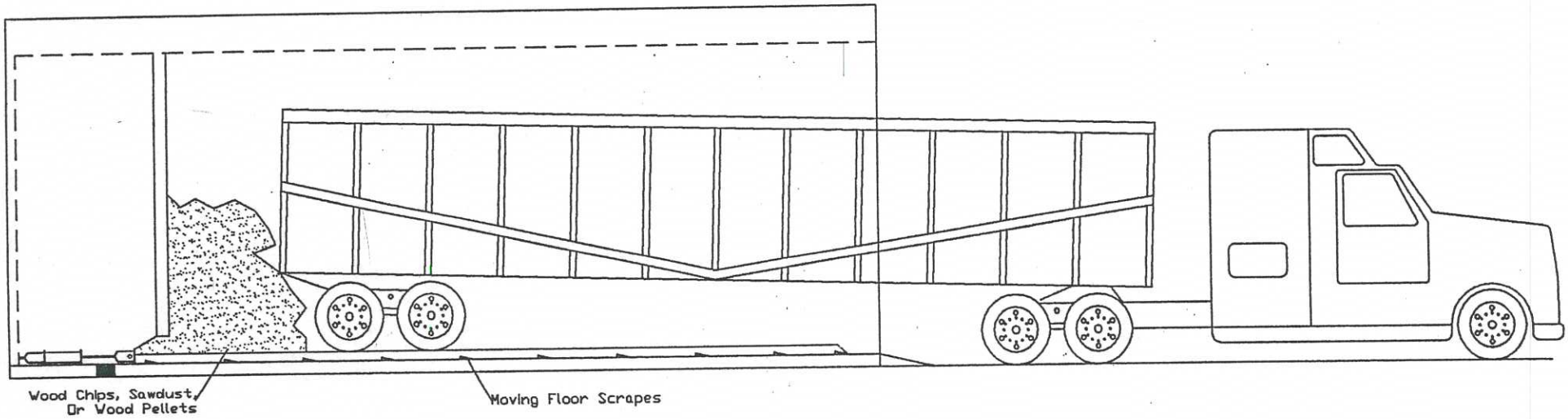


King Coal Package Boiler Room With Fuel Storage- For Schools, Hospitals, Sawmill & Kilndrying Operations Dimensioned For 135 HP Boiler

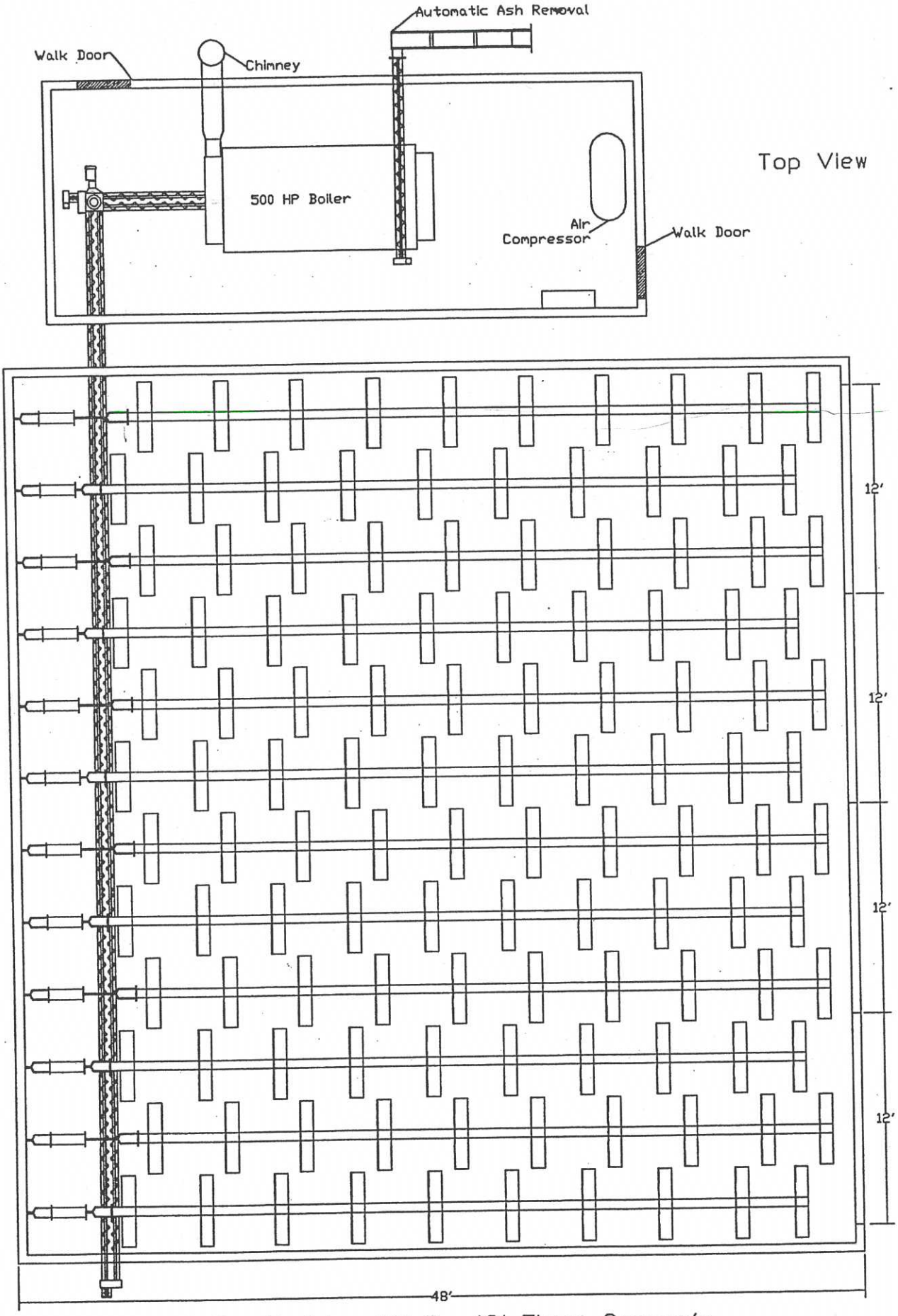




King Coal Floor Scrape Fuel Storage Prefab Building. These Storage Buildings Can Be Built 8'-10'-12'-14' Wide & 48' Long Or Can Be Ganged Together Side By Side For Greater Capacity.



The King Coal Advantage Is: You Can Back Your Fuel Delivery Truck On To The Floor Scrapes & Unload In The Building



4 Of Our Modular 12' By 48' Floor Scrape's
Combined To Make a 48' By 48' Building

May 29, 2003

Mr. Dan Stevenson
CTA Inc.
1500 Poly Drive
P. O. Box 1439
Billings, MT 59103
Phone: 406-896-6171 Fax: 406-248-3779
Cell: 406-670-8222 E-mail: dans@ctagroup.com

BUDGET QUOTATIONS: Eureka Public Schools
Prefabricated Boiler Plants and Fuel Storage Facilities
(Fuel -- Green Wood Chips)

SPECIFICATIONS:
Elementary and Middle Schools
Prefabricated skid mounted boiler room (12' wide, 30' long, 16' high - nominal size)
Contents include the following equipment and accessories:

- 80-HP steel fire tube boiler with factory installed trim and controls. Accessories include, manually operated soot blower, air compressor, refractory lined base with built-in stoker assembly, ash removal, dust collector, draft inducing fan, chimney, and PLC control system.

Prefabricated fuel storage facility (14' wide, 48' long, 17' high - nominal size)
Contents include the following equipment and accessories:

- Hydraulic floor scrape unloading system with twin-screw fuel metering conveyor that transports fuel to the adjoining stoker system. The interior walls shall be lined with wood planks. A hot water piping system shall be incorporated into the wall liner to provide heat to the storage facility. This heating system shall be connected to the stoker fired boiler. The storage facility shall be equipped with an overhead door to allow the fuel supply truck to back into the storage area to unload.

The above equipment is fabricated under strict quality control at KING COAL's manufacturing plant. Both the boiler room and fuel storage facility are modular structures that are designed for portability. This eliminates delays and field fabrication problems associated with on-site construction.
Budget cost **Elementary** and **Middle Schools** is **$530,000.00** ($265,000.00 each) +15,000 each for backup burner
plus shipping and any applicable taxes

BUDGET ESTIMATE
KC COST PER ABOVE- $265,000
ADD FOR SHIPPING $15,000
ADD FOR BACKUP BURNER $15,000
$295,000

High School

Prefabricated skid mounted boiler room (14' wide, 34' long, 18' high - nominal size) 165BHP
Contents include the following equipment and accessories: Kewanee

- 135-HP steel fire tube boiler with factory installed trim and controls. Accessories include, manually operated soot blower, air compressor, refractory lined base with built-in stoker assembly, ash removal, dust collector, draft inducing fan, chimney, and PLC control system. "MINT Condition"

Prefabricated fuel storage facility (14' wide, 48' long, 17' high - nominal size)
Contents include the following equipment and accessories:

- Hydraulic floor scrape unloading system with twin-screw fuel metering conveyor that transports fuel to the adjoining stoker system. The interior walls shall be lined with wood planks. A hot water piping system shall be incorporated into the wall liner to provide heat to the storage facility. This heating system shall be connected to the stoker fired boiler. The storage facility shall be equipped with an overhead door to allow the fuel supply truck to back into the storage area to unload.

The above equipment is fabricated under strict quality control at KING COAL's manufacturing plant. Both the boiler room and fuel storage facility are modular structures that are designed for portability. This eliminates delays and field fabrication problems associated with on-site construction.

Budget cost for the **High School** equipment package is **$315,000.00.** +15,000 (Backup Burner)
plus shipping and any applicable taxes

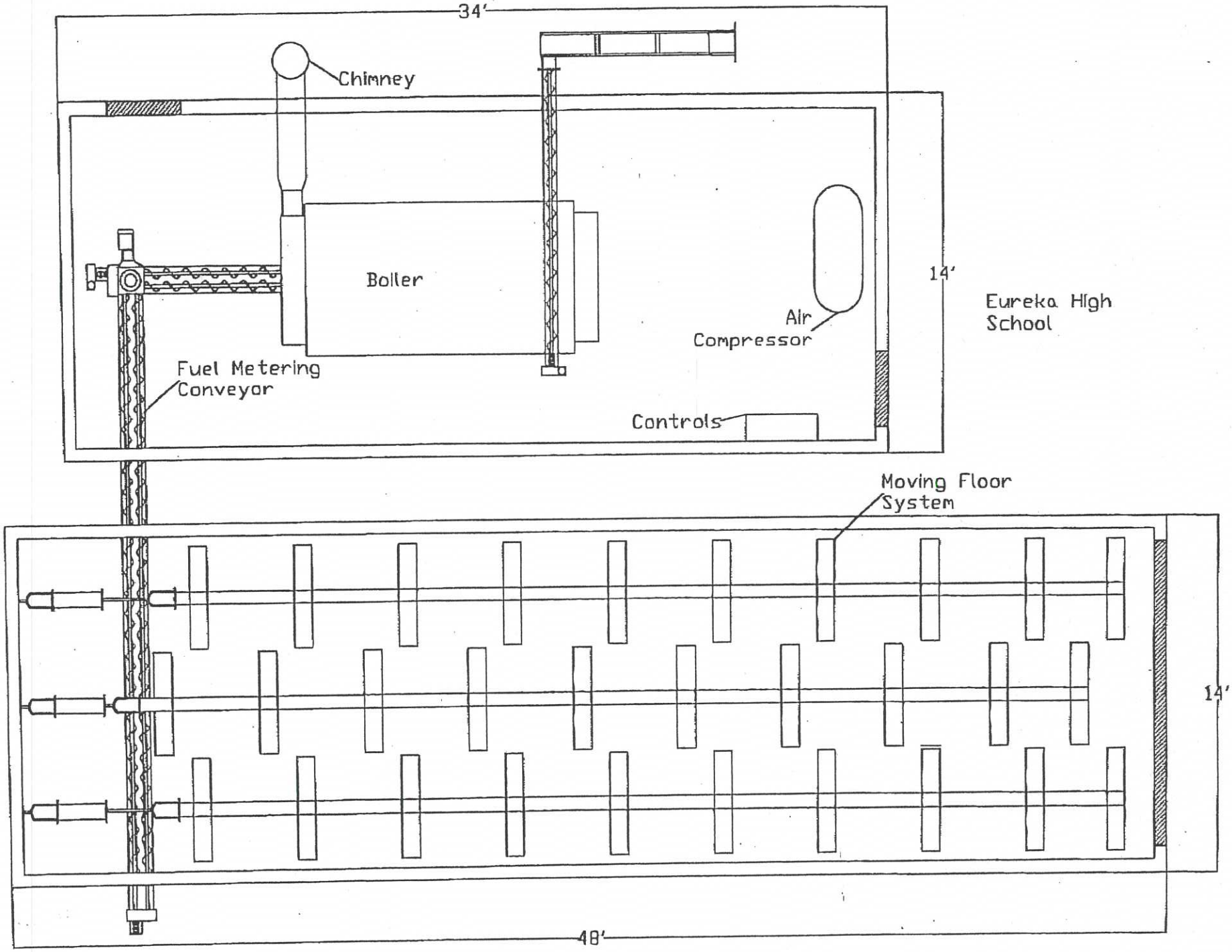
10 MMBTU 500-600

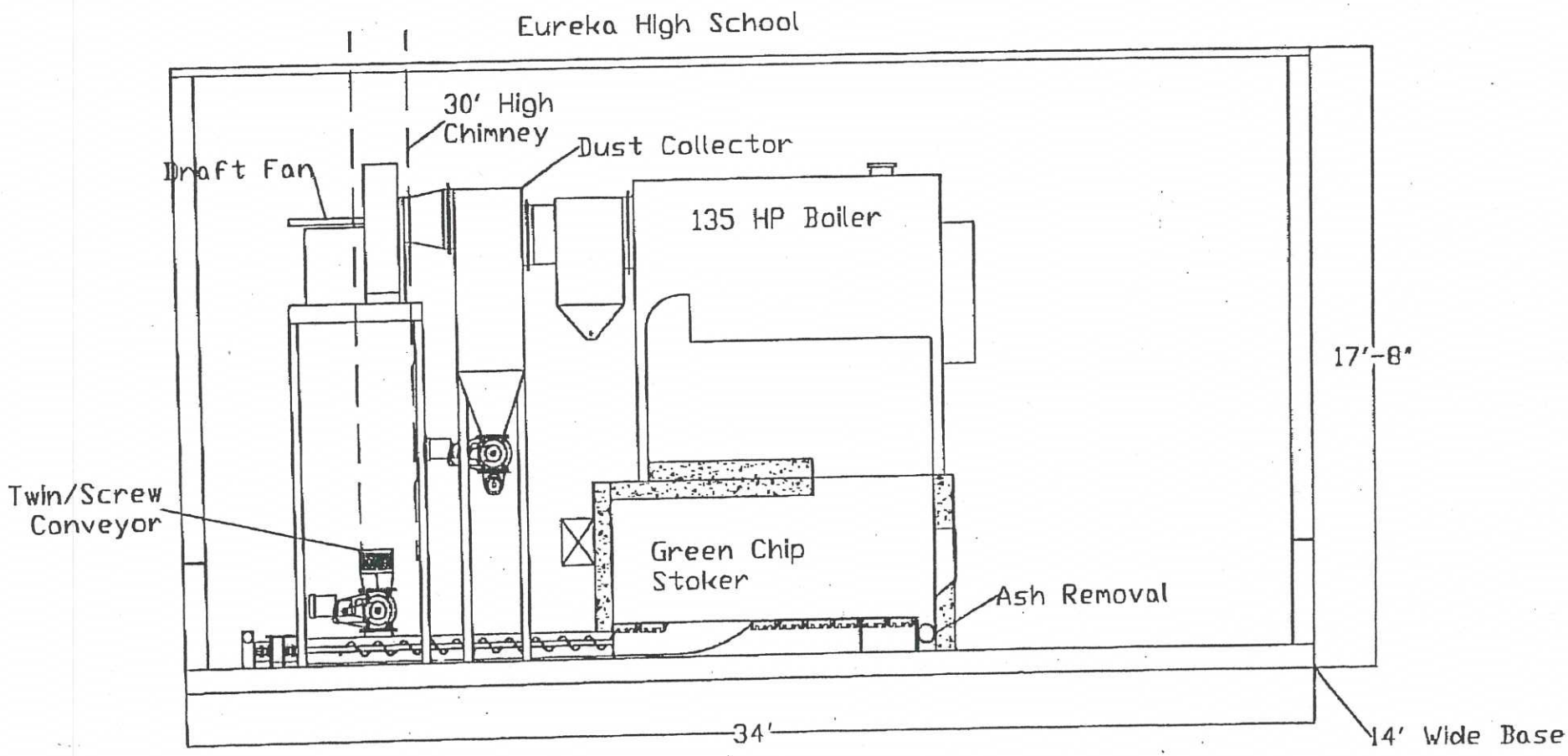
Following are several drawings that depict the equipment packages for the above project. Please feel free to contact Mike Robb or myself if you have any questions.

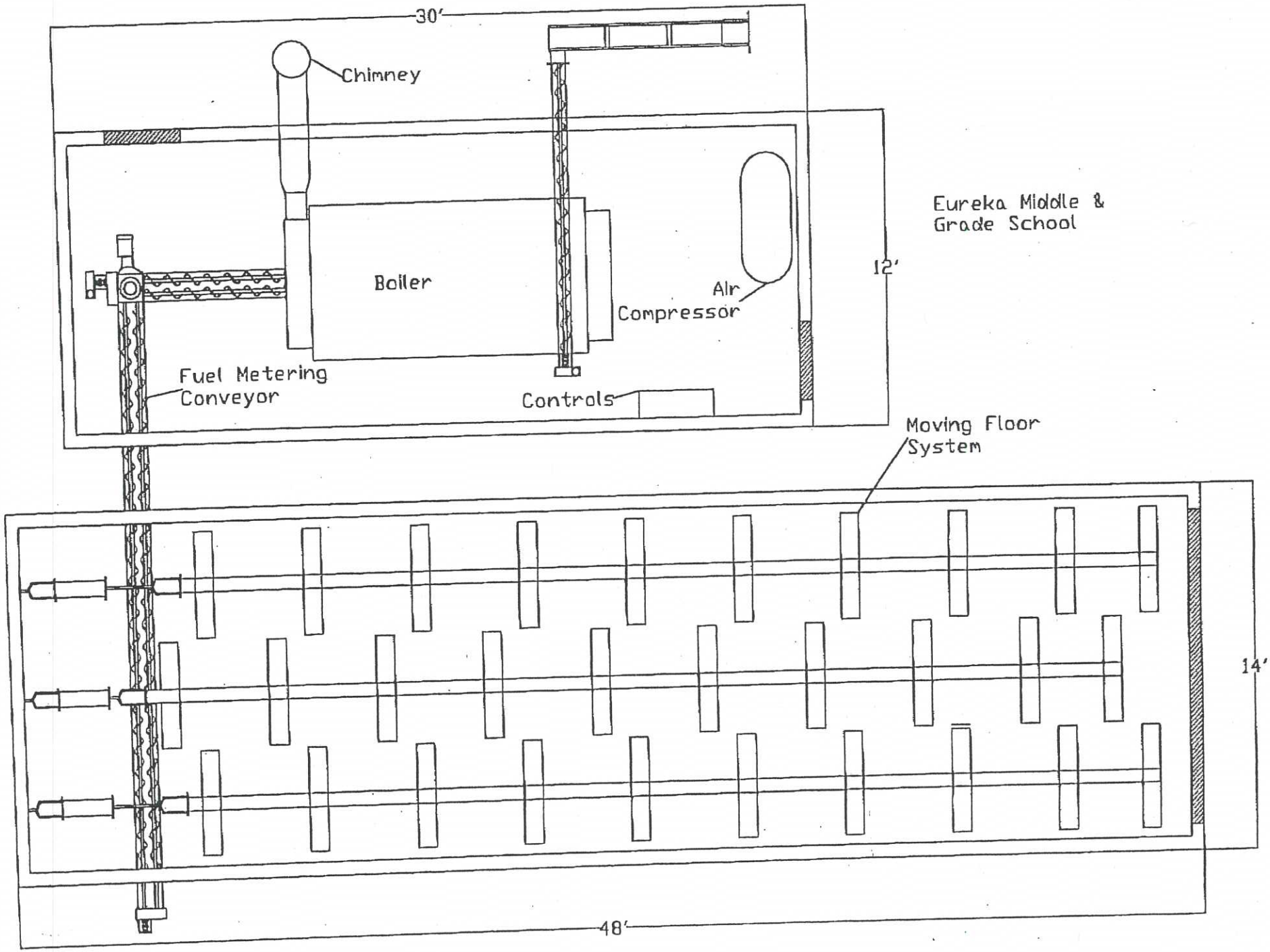
BUDGET ESTIMATE

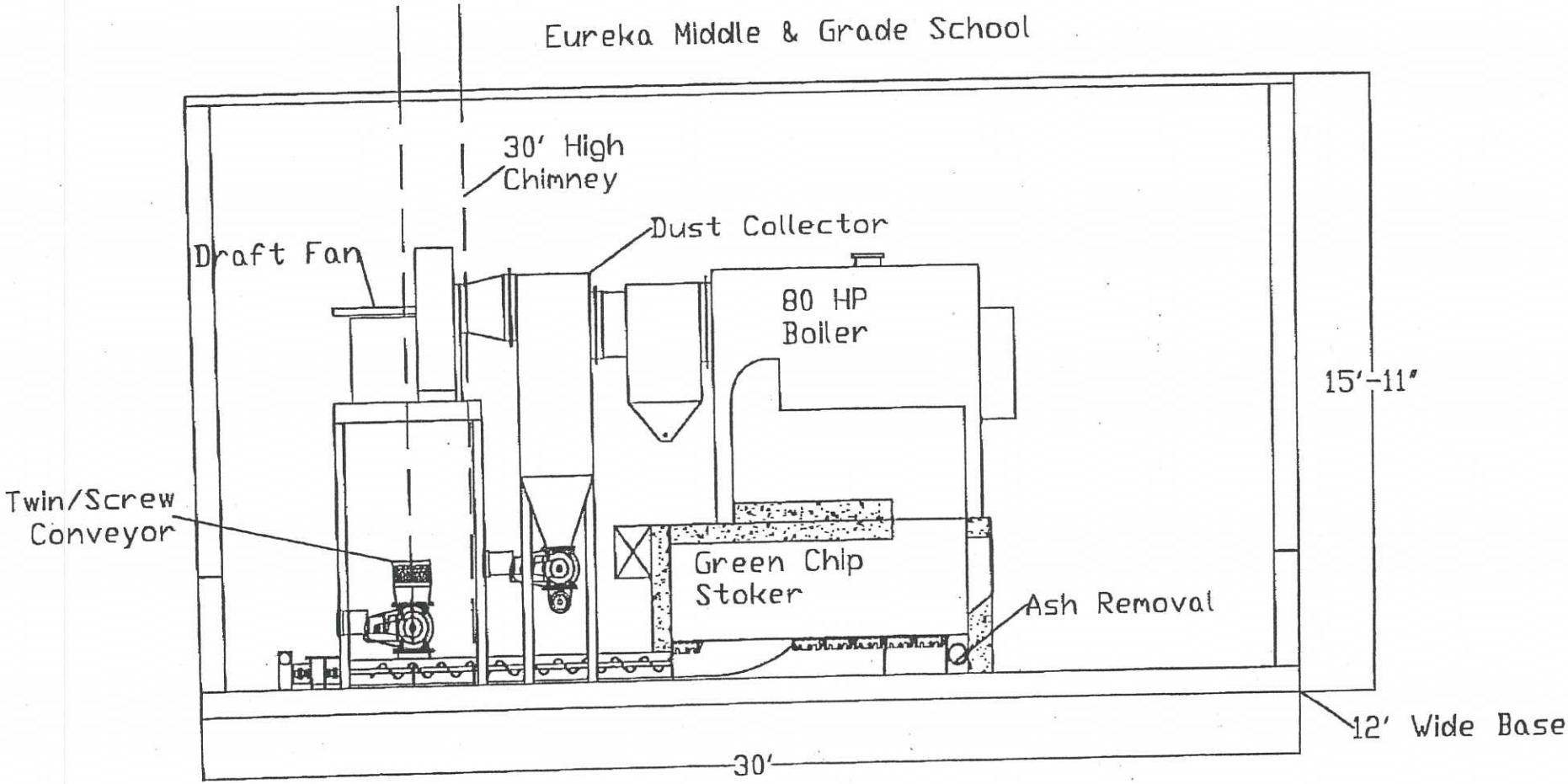
KC COST PER ABOVE -	$315,000
ADD FOR SHIPPING -	$10,000
ADD FOR BACK UP BURNER -	$15,000
ADD FOR BFW SPACE.	$10,000
BUDGET - 135 HP	$350,000

06/02/2003 16:33 701-255-6916 KING COAL PAGE 02


34'
Chimney
Boiler
14'
Eureka High
School
Air
Compressor
Fuel Metering
Conveyor
Controls
Moving Floor
System
14'
48'


Eureka High School
30' High Chimney
Dust Collector
Draft Fan
135 HP Boiler
17'-8"
Twin/Screw Conveyor
Green Chip Stoker
Ash Removal
34'
14' Wide Base


30'
Chimney
Boiler
Air
Compressor
Fuel Metering
Conveyor
Controls
12'
Eureka Middle &
Grade School
Moving Floor
System
14'
48'


Eureka Middle & Grade School
30' High Chimney
Dust Collector
Draft Fan
80 HP Boiler
15'-11"
Twin/Screw Conveyor
Green Chip Stoker
Ash Removal
12' Wide Base
30'

ENERGY DATA AND LOAD PROJECTION APPENDIX

Utility Rates	
Elec (GS-1 Schedule)	
Supply Charge $/kWh	0.039354
Transmission $/kw	
Combined Delivery Charges $/kWh	0.003508
Distribution Demand $/kW	5.388317
Total $/kWh	**0.042862**
Total $/kW	**5.388317**
Monthly Charge $	**8**
Natural Gas (D-GSG-1))	
Total $/Dkt (avg over 3 years)	**6.67**
	0

Granite County Hospital Usage

Year		January	February	March	April	May	June	July	August	September	October	November	December	Total
2000														
	kWh	-	-	-	-	-	19360	23280	20160	16080	15920	16960	18080	129840
	Peak (kW)	-	-	-	-	-	70	74	70	65	57	59	57	452
	Dkt	-	-	-	-	-	121	118	157	219	282	353	387	1637
	Elec kWh ($)	-	-	-	-	-	829.80	997.82	864.09	689.21	682.36	726.93	774.94	5565
	Elec kW ($)	-	-	-	-	-	377.18	398.74	377.18	350.24	307.13	317.91	307.13	2436
	Gas ($)	-	-	-	-	-	808.40	787.73	1045.86	1458.73	1878.94	2355.18	2581.29	10916
	Total (monthly fees inc.)	-	-	-	-	-	2023.39	2192.28	2295.13	2506.18	2876.43	3408.02	3671.36	18973
2001														
	kWh	15200	15120	16240	16160	15680	18640	19440	17760	16720	18000	16560	17840	203360
	Peak (kW)	58	56	55	54	59	64	60	58	59	58	61	62	704
	Dkt	352	300	271	225	175	122	128	130	192	267	305	354	2822
	Elec kWh ($)	651.50	648.07	696.07	692.64	672.07	798.94	833.23	761.22	716.65	771.51	709.79	764.65	8716
	Elec kW ($)	312.52	301.75	296.36	290.97	317.91	344.85	323.30	312.52	317.91	312.52	328.69	334.08	3793
	Gas ($)	2348.51	2000.33	1806.90	1501.42	1164.58	815.74	852.43	869.10	1281.97	1782.89	2037.02	2363.85	18825
	Total	3320.53	2958.15	2807.33	2493.03	2162.56	1967.53	2016.95	1950.85	2324.53	2874.92	3083.49	3470.57	31430
2002														
	kWh	16400	15600	15760	15440	17040	20640	19920	23120	17920	16560	16400	18640	213440
	Peak (kW)	61	58	59	62	61	63	67	68	64	61	62	65	751
	Dkt	302	314	262	234	208	151	136	201	236	309	301	400	3054
	Elec kWh ($)	702.93	668.64	675.50	661.78	730.36	884.66	853.80	990.96	768.08	709.79	702.93	798.94	9148
	Elec kW ($)	328.69	312.52	317.91	334.08	328.69	339.46	361.02	366.41	344.85	328.69	334.08	350.24	4047
	Gas ($)	2017.01	2092.38	1749.54	1560.11	1389.36	1003.84	909.12	1340.67	1574.12	2060.36	2009.00	2664.67	20370
	Total (monthly fees inc.)	3056.63	3081.54	2750.95	2563.97	2456.41	2235.96	2131.94	2706.04	2695.05	3106.84	3054.01	3821.85	33661
2003														
	kWh	15120	15360	15040	16160	20640	-	-	-	-	-	-	-	82320
	Peak (kW)	61	59	59	59	63	-	-	-	-	-	-	-	301
	Dkt	342	338	296	303	214	-	-	-	-	-	-	-	1492
	Elec kWh ($)	648.07	658.35	644.64	692.64	884.66	-	-	-	-	-	-	-	3528
	Elec kW ($)	328.69	317.91	317.91	317.91	339.46	-	-	-	-	-	-	-	1622
	Gas ($)	2277.81	2251.13	1975.65	2020.34	1424.05	-	-	-	-	-	-	-	9949
	Total (monthly fees inc.)	3262.56	3235.39	2946.20	3038.90	2656.17	-	-	-	-	-	-	-	15139
AVERAGE														
	kWh	15573	15360	15680	15920	17787	19547	20880	20347	16907	16827	16640	18187	209653.3
	Peak (kW)	60	58	58	58	61	66	67	65	63	59	61	61	736
	Dkt	332	317	276	254	199	131	127	163	216	286	320	380	3002
	Elec kWh ($)	667.50	658.35	672.07	682.36	762.36	837.80	894.95	872.09	724.65	721.22	713.22	779.51	8986
	Elec kW ($)	323.30	310.73	310.73	314.32	328.69	353.83	361.02	352.04	337.67	316.11	326.89	330.48	3966
	Gas ($)	2214.44	2114.61	1844.03	1693.96	1326.00	875.99	849.76	1085.21	1438.27	1907.40	2133.73	2536.60	20020
	Total (monthly fees inc.)	3213.24	3091.69	2834.83	2698.63	2425.05	2075.63	2113.73	2317.34	2508.59	2952.73	3181.84	3654.59	33068

Philipsburg Elementary School Usage

Year		January	February	March	April	May	June	July	August	September	October	November	December	Total
2000														
	kWh	-	-	-	-	-	2020	1940	4200	5140	5420	5780	5960	30460
	Peak (kW)	-	-	-	-	-	8	9	22	22	25	25	24	135
	Dkt	-	-	-	-	-	16	13	58	137	249	339	353	1165
	Elec kWh ($)	-	-	-	-	-	86.58	83.15	180.02	220.31	232.31	247.74	255.46	1306
	Elec kW ($)	-	-	-	-	-	43.11	48.49	118.54	118.54	134.71	134.71	129.32	727
	Gas ($)	-	-	-	-	-	106.72	86.71	386.86	913.79	1660.83	2261.13	2354.51	7771
	Total (monthly fees inc.)	-	-	-	-	-	244.41	226.36	693.42	1260.64	2035.85	2651.58	2747.28	9860
2001														
	kWh	5580	5280	5160	4720	2740	1880	2040	3880	4560	5160	5440	5500	51940
	Peak (kW)	24	22	24	22	19	10	11	24	20	22	22	22	242
	Dkt	329	251	214	138	55	17	16	25	95	207	310	365	2022
	Elec kWh ($)	239.17	226.31	221.17	202.31	117.44	80.58	87.44	166.30	195.45	221.17	233.17	235.74	2226
	Elec kW ($)	129.32	118.54	129.32	118.54	102.38	53.88	59.27	129.32	107.77	118.54	118.54	118.54	1304
	Gas ($)	2194.43	1674.17	1427.38	920.46	366.85	113.39	106.72	166.75	633.65	1380.69	2067.70	2434.55	13487
	Total (monthly fees inc.)	2570.92	2027.02	1785.87	1249.31	594.67	255.85	261.43	470.37	944.87	1728.40	2427.41	2796.83	17113
2002														
	kWh	5840	5400	4920	4320	3260	2060	2020	4300	4760	5380	5440	5420	53120
	Peak (kW)	23	22	21	22	19	10	13	20	20	20	21	22	233
	Dkt	313	323	222	182	78	201	127	215	109	255	255	340	2620
	Elec kWh ($)	250.31	231.45	210.88	185.16	139.73	88.29	86.58	184.30	204.02	230.60	233.17	232.31	2277
	Elec kW ($)	123.93	118.54	113.15	118.54	102.38	53.88	70.05	107.77	107.77	107.77	113.15	118.54	1255
	Gas ($)	2087.71	2154.41	1480.74	1213.94	520.26	1340.67	847.09	1434.05	727.03	1700.85	1700.85	2267.80	17475
	Total (monthly fees inc.)	2469.95	2512.41	1812.77	1525.65	770.37	1490.85	1011.72	1734.12	1046.82	2047.21	2055.17	2626.65	21104
2003														
	kWh	5700	5620	4640	4500	3160	-	-	-	-	-	-	-	23620
	Peak (kW)	24	22	20	21	21	-	-	-	-	-	-	-	108
	Dkt	272	278	194	174	60.3	-	-	-	-	-	-	-	978
	Elec kWh ($)	244.31	240.88	198.88	192.88	135.44	-	-	-	-	-	-	-	1012
	Elec kW ($)	129.32	118.54	107.77	113.15	113.15	-	-	-	-	-	-	-	582
	Gas ($)	1814.24	1854.26	1293.98	1160.58	402.20	-	-	-	-	-	-	-	6525
	Total (monthly fees inc.)	2195.87	2221.69	1608.62	1474.61	658.80	-	-	-	-	-	-	-	8160
AVERAGE														
	kWh	5707	5433	4907	4513	3053	1987	2000	4127	4820	5320	5553	5627	53046.67
	Peak (kW)	24	22	22	22	20	9	11	22	21	22	23	23	239.3333
	Dkt	305	284	210	165	64	78	52	99	114	237	301	353	2262
	Elec kWh ($)	244.60	232.88	210.31	193.45	130.87	85.15	85.72	176.88	206.59	228.02	238.02	241.17	2274
	Elec kW ($)	127.52	118.54	116.75	116.75	105.97	50.29	59.27	118.54	111.36	120.34	122.14	122.14	1290
	Gas ($)	2032.13	1894.28	1400.70	1098.33	429.77	520.26	346.84	662.55	758.16	1580.79	2009.89	2352.29	15086
	Total (monthly fees inc.)	2412.25	2253.70	1735.75	1416.52	674.61	663.70	499.83	965.97	1084.11	1937.15	2378.05	2723.59	18745

Philipsburg High School Usage

Year		January	February	March	April	May	June	July	August	September	October	November	December	Total
2000														
	kWh	-	-	-	-	-	9640	9720	21560	27880	29120	30520	35400	163840
	Peak (kW)	-	-	-	-	-	35	39	98	103	107	114	109	605
	Dkt	-	-	-	-	-	34	28	125	292	527	716	752	2474
	Elec kWh ($)	-	-	-	-	-	413.19	416.61	924.10	1194.98	1248.13	1308.14	1517.30	7022
	Elec kW ($)	-	-	-	-	-	188.59	210.14	528.06	555.00	576.55	614.27	587.33	3260
	Gas ($)	-	-	-	-	-	227.45	183.43	833.75	1948.97	3515.09	4778.39	5014.51	16502
	Total (monthly fees inc.)	-	-	-	-	-	837.22	818.18	2293.90	3706.95	5347.77	6708.79	7127.13	26840
2001														
	kWh	32160	29960	30080	28720	16200	9240	10040	21920	26320	30840	30400	30480	296360
	Peak (kW)	108	107	107	103	101	36	45	96	101	106	104	100	1114
	Dkt	692	548	464	298	120	37	37	55	208	451	663	775	4346
	Elec kWh ($)	1378.43	1284.13	1289.28	1230.99	694.36	396.04	430.33	939.53	1128.12	1321.85	1302.99	1306.42	12702
	Elec kW ($)	581.94	576.55	576.55	555.00	544.22	193.98	242.47	517.28	544.22	571.16	560.38	538.83	6003
	Gas ($)	4618.31	3652.49	3091.55	1984.33	801.73	243.46	244.79	367.52	1386.69	3006.84	4421.54	5169.25	28988
	Total (monthly fees inc.)	6586.68	5521.18	4965.37	3778.31	2048.31	841.48	925.59	1832.32	3067.03	4907.85	6292.92	7022.50	47790
2002														
	kWh	31240	30440	28440	27840	19520	10680	10960	21280	26800	31160	32160	33200	303720
	Peak (kW)	108	104	109	109	100	34	35	95	95	102	102	107	1100
	Dkt	665	686	482	393	169	34	28	47	240	557	557	739	4596
	Elec kWh ($)	1339.00	1304.71	1218.98	1193.27	836.66	457.76	469.76	912.09	1148.69	1335.57	1378.43	1423.01	13018
	Elec kW ($)	581.94	560.38	587.33	587.33	538.83	183.20	188.59	511.89	511.89	549.61	549.61	576.55	5927
	Gas ($)	4436.88	4575.62	3212.27	2621.98	1129.23	228.78	184.09	312.82	1601.47	3711.86	3712.52	4926.46	30654
	Total (monthly fees inc.)	6365.82	6448.71	5026.58	4410.57	2512.72	877.75	850.45	1744.81	3270.05	5605.03	5648.56	6934.02	49695
2003														
	kWh	33920	31680	27320	29520	19480	-	-	-	-	-	-	-	141920
	Peak (kW)	106	104	102	98	91	-	-	-	-	-	-	-	501
	Dkt	596	606	426	379	131	-	-	-	-	-	-	-	2138
	Elec kWh ($)	1453.87	1357.86	1170.98	1265.27	834.94	-	-	-	-	-	-	-	6083
	Elec kW ($)	571.16	560.38	549.61	528.06	490.34	-	-	-	-	-	-	-	2700
	Gas ($)	3971.99	4044.69	2840.09	2530.60	874.44	-	-	-	-	-	-	-	14262
	Total (monthly fees inc.)	6005.01	5970.93	4568.67	4331.93	2207.72	-	-	-	-	-	-	-	23084
AVERAGE														
	kWh	32440	30693	28613	28693	18400	9853	10240	21587	27000	30373	31027	33027	301946.7
	Peak (kW)	107	105	106	103	97	35	40	96	100	105	107	105	1106.667
	Dkt	651	613	457	357	140	35	31	76	247	511	645	755	4518
	Elec kWh ($)	1390.43	1315.57	1226.41	1229.84	788.65	422.33	438.90	925.24	1157.26	1301.85	1329.85	1415.58	12942
	Elec kW ($)	578.35	565.77	571.16	556.79	524.46	188.59	213.74	519.07	537.04	565.77	574.75	567.57	5963
	Gas ($)	4342.39	4090.93	3047.97	2378.97	935.13	233.23	204.10	504.70	1645.71	3411.26	4304.15	5036.74	30135
	Total (monthly fees inc.)	6319.17	5980.27	4853.54	4173.60	2256.25	852.15	864.74	1957.01	3348.01	5286.88	6216.76	7027.88	49136

Total Usage (3 buildings)

Year		January	February	March	April	May	June	July	August	September	October	November	December	Total
2000														
	kWh	-	-	-	-	-	31020	34940	45920	49100	50460	53260	59440	324140
	Peak (kW)	-	-	-	-	-	113	122	190	190	189	198	190	1192
	Dkt	-	-	-	-	-	171.3	158.6	339.8	647.9	1057.7	1408.5	1491.8	5275.6
	Elec kWh ($)	-	-	-	-	-	1329.57	1497.58	1968.20	2104.50	2162.80	2282.81	2547.69	13893.16
	Elec kW ($)	-	-	-	-	-	608.88	657.37	1023.78	1023.78	1018.39	1066.89	1023.78	6422.874
	Gas ($)	-	-	-	-	-	1142.57	1057.86	2266.47	4321.49	7054.86	9394.70	9950.31	35188.25
	Total (monthly fees inc.)	-	-	-	-	-	3105.02	3236.82	5282.45	7473.78	10260.05	12768.39	13545.78	55672.28
2001														
	kWh	52940	50360	51480	49600	34620	29760	31520	43560	47600	54000	52400	53820	551660
	Peak (kW)	190	185	186	179	179	110	116	178	180	186	187	184	2060
	Dkt	1373.5	1098.5	948.4	660.6	349.8	175.8	180.5	210.4	495.1	925.1	1278.3	1494.4	9190
	Elec kWh ($)	2269.09	2158.51	2206.52	2125.94	1483.87	1275.56	1351.00	1867.05	2040.21	2314.53	2245.95	2306.81	23645
	Elec kW ($)	1023.78	996.84	1002.23	964.51	964.51	592.71	625.04	959.12	969.90	1002.23	1007.62	991.45	11100
	Gas ($)	9161.25	7327.00	6325.83	4406.20	2333.17	1172.59	1203.94	1403.37	3302.32	6170.42	8526.26	9967.65	61300
	Total (monthly fees inc.)	12478.12	10506.34	9558.57	7520.65	4805.54	3064.86	3203.98	4253.54	6336.43	9511.17	11803.82	13289.91	96333
2002														
	kWh	53480	51440	49120	47600	39820	33380	32900	48700	49480	53100	54000	57260	570280
	Peak (kW)	192	184	189	193	180	107	115	183	179	183	185	194	2084
	Dkt	1280.6	1322.7	965.9	809	455.6	385.8	290.9	462.9	585.1	1120.4	1112.8	1478.1	10270
	Elec kWh ($)	2292.24	2204.80	2105.36	2040.21	1706.75	1430.72	1410.15	2087.36	2120.79	2275.95	2314.53	2454.26	24443
	Elec kW ($)	1034.56	991.45	1018.39	1039.95	969.90	576.55	619.66	986.06	964.51	986.06	996.84	1045.33	11229
	Gas ($)	8541.60	8822.41	6442.55	5396.03	3038.85	2573.29	1940.30	3087.54	3902.62	7473.07	7422.38	9858.93	68500
	Total (monthly fees inc.)	11892.40	12042.66	9590.31	8500.19	5739.50	4604.56	3994.11	6184.96	7011.92	10759.08	10757.74	13382.52	104460
2003														
	kWh	54740	52660	47000	50180	43280	-	-	-	-	-	-	-	247860
	Peak (kW)	191	185	181	178	175	-	-	-	-	-	-	-	910
	Dkt	1209	1221.9	916	856.3	404.9	-	-	-	-	-	-	-	4608
	Elec kWh ($)	2346.24	2257.09	2014.50	2150.80	1855.05	-	-	-	-	-	-	-	10624
	Elec kW ($)	1029.17	996.84	975.29	959.12	942.96	-	-	-	-	-	-	-	4903
	Gas ($)	8064.03	8150.07	6109.72	5711.52	2700.68	-	-	-	-	-	-	-	30736
	Total (monthly fees inc.)	11463.44	11428.00	9123.50	8845.44	5522.69	-	-	-	-	-	-	-	46383
AVERAGE														
	kWh	53720	51487	49200	49127	39240	31387	33120	46060	48727	52520	53220	56840	564646.7
	Peak (kW)	191	185	185	183	178	110	118	184	183	186	190	189	2082
	Dkt	1288	1214	943	775	403	244	210	338	576	1034	1267	1488	9781
	Elec kWh ($)	2302.53	2206.80	2108.79	2105.65	1681.89	1345.28	1419.58	1974.21	2088.50	2251.09	2281.09	2436.25	24202
	Elec kW ($)	1029.17	995.04	998.63	987.86	959.12	592.71	634.03	989.65	986.06	1002.23	1023.78	1020.19	11218
	Gas ($)	8588.96	8099.83	6292.70	5171.25	2690.90	1629.48	1400.70	2252.46	3842.14	6899.45	8447.78	9925.63	65241
	Total (monthly fees inc.)	11944.65	11325.67	9424.13	8288.76	5355.91	3591.48	3478.30	5240.32	6940.71	10176.77	11776.65	13406.07	100949

Bonners Ferry High School Biomass Heating Economic Analysis

Conversion Proforma for Bonners Ferry High School - 5.21% APR, $330,000 Grant - 10 Year Term

March 26, 2004
Revision:32604a
Analyst: Stevenson-CTA

Project Project Cost including fees & 10% const. contingency	($581,922)

$501,845 Estimated Construction Cost (increase since August 2003: larger building, escalated steel costs)
$50,185 10% Construction Contingency
$29,892 Design Fees, Printing, Travel

Project Financing Information	
Percent Financed	43%
Amount Financed	-$251,922
Amount of Grants	-$330,000
Interest Rate	5.21%
Term (years)	10
Annual Finance Cost	-$32,959

Year One Fuel Price:		
Wood Chips	$6.57	/ton
Pellets	$70.00	/ton
Fuel Oil		/gallon
Propane		/gallon
Natural Gas	$7.80	/mmbtu
Electric	$0.0449	/kwh

Escalation factors	
Elec. Escalation factor	1.04
Natural Gas Escalation factor	1.04
Fuel Oil Escalation factor	1.04
Pellet Escalation factor	1.03
Green Chip Escalation factor	1.02
Maint. Escalation factor	1.03

Cashflow Descriptions	Unit Costs	Heating Source Proportion	Annual Heating Source Volumes	Heating Units	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Existing Heating System Operating Costs																			
Displaced electric resistance heating costs	$0.045		724029	KWH	32,509	33,809	35,162	36,568	38,031	39,552	41,134	42,779	44,491	46,270	48,121	50,046	52,048	54,130	56,295
Displaced Operation and Maintenance Costs					570	587	605	623	642	661	681	701	722	744	766	789	813	837	862
Biomass System Operating Costs																			
Green Chip Fuel ($/ton, delivered to boiler site, btu/lb) (90% of total heat rqmnt)	$6.57	85%	422	tons	2,359	2,406	2,454	2,503	2,553	2,604	2,657	2,710	2,764	2,819	2,876	2,933	2,992	3,052	3,113
Small load natural gas (10% of total heat rqmnt)	$7.80	15%	3802	full load MMBtu	4,448	4,626	4,811	5,003	5,204	5,412	5,628	5,853	6,087	6,331	6,584	6,847	7,121	7,406	7,702
Operation and Maintenance Costs					1,710	1,761	1,814	1,869	1,925	1,982	2,042	2,103	2,166	2,231	2,298	2,367	2,438	2,511	2,587
Annual Operating Cost Savings					***24,562***	***25,603***	***26,687***	***27,816***	***28,991***	***30,214***	***31,488***	***32,814***	***34,195***	***35,633***	***37,129***	***38,687***	***40,309***	***41,998***	***43,755***
Financed Project Costs - Principal and Interest					***(32,959)***	***(32,959)***	***(32,959)***	***(32,959)***	***(32,959)***	***(32,959)***	***(32,959)***	***(32,959)***	***(32,959)***	***(32,959)***					
Displaced System Replacement Costs					***0***														
Special financing																			
USDA Green ton subsidy (Note 1) ($/ton, Green chip tons/year) (Notes 5&6)	$0.00		359		0	0	0	0	0	0	0	0	0	0					
Net Annual Cash Flow					***(8,397)***	***(7,356)***	***(6,272)***	***(5,143)***	***(3,968)***	***(2,744)***	***(1,470)***	***(144)***	***1,237***	***2,674***	***37,129***	***38,687***	***40,309***	***41,998***	***43,755***
Cumulative Cash Flow					***(8,397)***	***(15,752)***	***(22,024)***	***(27,167)***	***(31,135)***	***(33,879)***	***(35,349)***	***(35,493)***	***(34,257)***	***(31,583)***	***5,547***	***44,234***	***84,543***	***126,541***	***170,297***

Cashflow Descriptions	Unit Costs	Heating Source Proportion	Annual Heating Source Volumes	Heating Units	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30
Existing Heating System Operating Costs																			
Displaced electric resistance heating costs					58,547	60,889	63,324	65,857	68,491	71,231	74,080	77,043	80,125	83,330	86,663	90,130	93,735	97,485	101,384
Displaced Operation and Maintenance Costs					888	915	942	970	999	1,029	1,060	1,092	1,125	1,159	1,193	1,229	1,266	1,304	1,343
Biomass System Operating Costs																			
Green Chip Fuel ($/ton, delivered to boiler site, btu/lb) (90% of total heat rqmnt)					3,175	3,238	3,303	3,369	3,437	3,505	3,575	3,647	3,720	3,794	3,870	3,948	4,026	4,107	4,189
Small load natural gas (10% of total heat rqmnt)					8,011	8,331	8,664	9,011	9,371	9,746	10,136	10,541	10,963	11,402	11,858	12,332	12,825	13,338	13,872
Operation and Maintenance Costs					2,664	2,744	2,826	2,911	2,998	3,088	3,181	3,277	3,375	3,476	3,580	3,688	3,798	3,912	4,030
Annual Operating Cost Savings					***45,585***	***47,490***	***49,472***	***51,536***	***53,685***	***55,921***	***58,248***	***60,671***	***63,192***	***65,817***	***68,549***	***71,392***	***74,351***	***77,431***	***80,637***
Financed Project Costs - Principal and Interest																			
Displaced System Replacement Costs																			
Special financing																			
USDA Green ton subsidy (Note 1) ($/ton, Green chip tons/year) (Notes 5&6)																			
Net Annual Cash Flow					***45,585***	***47,490***	***49,472***	***51,536***	***53,685***	***55,921***	***58,248***	***60,671***	***63,192***	***65,817***	***68,549***	***71,392***	***74,351***	***77,431***	***80,637***
Cumulative Cash Flow					***215,882***	***263,372***	***312,844***	***364,380***	***418,065***	***473,986***	***532,234***	***592,905***	***656,097***	***721,914***	***790,463***	***861,855***	***936,206***	***1,013,637***	***1,094,274***

B

Bonners Ferry High School Biomass Heating Economic Analysis

Conversion Proforma for Bonners Ferry High School - 5.21% APR, $330,000 Grant - 10 Year Term

March 26, 2004
Revision:32604b
Analyst: Stevenson-CTA

Project Project Cost including fees & 10% const. contingency	($581,922)

$501,845 Estimated Construction Cost (increase since August 2003: larger building, escalated steel costs)
$50,185 10% Construction Contingency
$29,892 Design Fees, Printing, Travel

Project Financing Information	
Percent Financed	43%
Amount Financed	-$251,922
Amount of Grants	-$330,000
Interest Rate	5.21%
Term (years)	10
Annual Finance Cost	-$32,959

Year One Fuel Price:		
Wood Chips	$6.57	/ton
Pellets	$70.00	/ton
Fuel Oil		/gallon
Propane		/gallon
Natural Gas	$7.80	/mmbtu
Electric	$0.0449	/kwh

Escalation factors	
Elec. Escalation factor	1.04
Natural Gas Escalation factor	1.04
Fuel Oil Escalation factor	1.04
Pellet Escalation factor	1.03
Green Chip Escalation factor	1.02
Maint. Escalation factor	1.03

Cashflow Descriptions	Unit Costs	Heating Source Proportion	Annual Heating Source Volumes	Heating Units	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Existing Heating System Operating Costs																			
Displaced electric resistance heating costs	$0.045		724029	KWH	32,509	33,809	35,162	36,568	38,031	39,552	41,134	42,779	44,491	46,270	48,121	50,046	52,048	54,130	56,295
Displaced Operation and Maintenance Costs					570	587	605	623	642	661	681	701	722	744	766	789	813	837	862
Biomass System Operating Costs																			
Green Chip Fuel ($/ton, delivered to boiler site, btu/lb) (90% of total heat rqmnt)	$6.57	85%	422	tons	2,359	2,406	2,454	2,503	2,553	2,604	2,657	2,710	2,764	2,819	2,876	2,933	2,992	3,052	3,113
Small load natural gas (10% of total heat rqmnt)	$7.80	15%	3802	full load MMBtu	4,448	4,626	4,811	5,003	5,204	5,412	5,628	5,853	6,087	6,331	6,584	6,847	7,121	7,406	7,702
Operation and Maintenance Costs					1,710	1,761	1,814	1,869	1,925	1,982	2,042	2,103	2,166	2,231	2,298	2,367	2,438	2,511	2,587
Annual Operating Cost Savings					***24,562***	***25,603***	***26,687***	***27,816***	***28,991***	***30,214***	***31,488***	***32,814***	***34,195***	***35,633***	***37,129***	***38,687***	***40,309***	***41,998***	***43,755***
Financed Project Costs - Principal and Interest					***(32,959)***	***(32,959)***	***(32,959)***	***(32,959)***	***(32,959)***	***(32,959)***	***(32,959)***	***(32,959)***	***(32,959)***	***(32,959)***					
Displaced System Replacement Costs (natural gas boiler)					***25,000***														
Special financing																			
USDA Green ton subsidy (Note 1) ($/ton, Green chip tons/year) (Notes 5&6)	$0.00		359		0	0	0	0	0	0	0	0	0	0					
Net Annual Cash Flow					***16,603***	***(7,356)***	***(6,272)***	***(5,143)***	***(3,968)***	***(2,744)***	***(1,470)***	***(144)***	***1,237***	***2,674***	***37,129***	***38,687***	***40,309***	***41,998***	***43,755***
Cumulative Cash Flow					***16,603***	***9,248***	***2,976***	***(2,167)***	***(6,135)***	***(8,879)***	***(10,349)***	***(10,493)***	***(9,257)***	***(6,583)***	***30,547***	***69,234***	***109,543***	***151,541***	***195,297***

Cashflow Descriptions	Unit Costs	Heating Source Proportion	Annual Heating Source Volumes	Heating Units	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30
Existing Heating System Operating Costs																			
Displaced electric resistance heating costs					58,547	60,889	63,324	65,857	68,491	71,231	74,080	77,043	80,125	83,330	86,663	90,130	93,735	97,485	101,384
Displaced Operation and Maintenance Costs					888	915	942	970	999	1,029	1,060	1,092	1,125	1,159	1,193	1,229	1,266	1,304	1,343
Biomass System Operating Costs																			
Green Chip Fuel ($/ton, delivered to boiler site, btu/lb) (90% of total heat rqmnt)					3,175	3,238	3,303	3,369	3,437	3,505	3,575	3,647	3,720	3,794	3,870	3,948	4,026	4,107	4,189
Small load natural gas (10% of total heat rqmnt)					8,011	8,331	8,664	9,011	9,371	9,746	10,136	10,541	10,963	11,402	11,858	12,332	12,825	13,338	13,872
Operation and Maintenance Costs					2,664	2,744	2,826	2,911	2,998	3,088	3,181	3,277	3,375	3,476	3,580	3,688	3,798	3,912	4,030
Annual Operating Cost Savings					***45,585***	***47,490***	***49,472***	***51,536***	***53,685***	***55,921***	***58,248***	***60,671***	***63,192***	***65,817***	***68,549***	***71,392***	***74,351***	***77,431***	***80,637***
Financed Project Costs - Principal and Interest																			
Displaced System Replacement Costs																			
Special financing																			
USDA Green ton subsidy (Note 1) ($/ton, Green chip tons/year) (Notes 5&6)																			
Net Annual Cash Flow					***45,585***	***47,490***	***49,472***	***51,536***	***53,685***	***55,921***	***58,248***	***60,671***	***63,192***	***65,817***	***68,549***	***71,392***	***74,351***	***77,431***	***80,637***
Cumulative Cash Flow					***240,882***	***288,372***	***337,844***	***389,380***	***443,065***	***498,986***	***557,234***	***617,905***	***681,097***	***746,914***	***815,463***	***886,855***	***961,206***	***1,038,637***	***1,119,274***

Bonners Ferry High School Biomass Heating Economic Analysis

Conversion Proforma for Bonners Ferry High School - 5.21% APR, $330,000 Grant - 10 Year Term

March 26, 2004
Revision:32604b
Analyst: Stevenson-CTA

Project Project Cost including fees & 10% const. contingency	($581,922)

$501,845 Estimated Construction Cost (increase since August 2003: larger building, escalated steel costs)
$50,185 10% Construction Contingency
$29,892 Design Fees, Printing, Travel

Project Financing Information	
Percent Financed	43%
Amount Financed	-$251,922
Amount of Grants	-$330,000
Interest Rate	5.21%
Term (years)	10
Annual Finance Cost	-$32,959

Year One Fuel Price:		
Wood Chips	$6.57	/ton
Pellets	$70.00	/ton
Fuel Oil		/gallon
Propane		/gallon
Natural Gas	$7.80	/mmbtu
Electric	$0.0449	/kwh

Escalation factors	
Elec. Escalation factor	1.04
Natural Gas Escalation factor	1.04
Fuel Oil Escalation factor	1.04
Pellet Escalation factor	1.03
Green Chip Escalation factor	1.02
Maint. Escalation factor	1.03

Cashflow Descriptions	Unit Costs	Heating Source Proportion	Annual Heating Source Volumes	Heating Units	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Existing Heating System Operating Costs																			
Displaced electric resistance heating costs	$0.045		724029	KWH	32,509	33,809	35,162	36,568	38,031	39,552	41,134	42,779	44,491	46,270	48,121	50,046	52,048	54,130	56,295
Displaced Operation and Maintenance Costs					570	587	605	623	642	661	681	701	722	744	766	789	813	837	862
Biomass System Operating Costs																			
Green Chip Fuel ($/ton, delivered to boiler site, btu/lb) (90% of total heat rqmnt)	$6.57	100%	422	tons	2,775	2,831	2,887	2,945	3,004	3,064	3,125	3,188	3,252	3,317	3,383	3,451	3,520	3,590	3,662
Small load natural gas (10% of total heat rqmnt)	$7.80	0%	3802	full load MMBtu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operation and Maintenance Costs					1,710	1,761	1,814	1,869	1,925	1,982	2,042	2,103	2,166	2,231	2,298	2,367	2,438	2,511	2,587
Annual Operating Cost Savings					***28,594***	***29,804***	***31,065***	***32,377***	***33,744***	***35,166***	***36,648***	***38,190***	***39,795***	***41,466***	***43,206***	***45,017***	***46,903***	***48,866***	***50,909***
Financed Project Costs - Principal and Interest					***(32,959)***	***(32,959)***	***(32,959)***	***(32,959)***	***(32,959)***	***(32,959)***	***(32,959)***	***(32,959)***	***(32,959)***	***(32,959)***					
Displaced System Replacement Costs (natural gas boiler)					***25,000***														
Special financing																			
USDA Green ton subsidy (Note 1) ($/ton, Green chip tons/year) (Notes 5&6)	$0.00		422		0	0	0	0	0	0	0	0	0	0					
Net Annual Cash Flow					***20,635***	***(3,154)***	***(1,894)***	***(581)***	***785***	***2,208***	***3,689***	***5,231***	***6,836***	***8,508***	***43,206***	***45,017***	***46,903***	***48,866***	***50,909***
Cumulative Cash Flow					***20,635***	***17,481***	***15,587***	***15,006***	***15,791***	***17,999***	***21,688***	***26,918***	***33,755***	***42,262***	***85,468***	***130,486***	***177,388***	***226,254***	***277,163***

Cashflow Descriptions	Unit Costs	Heating Source Proportion	Annual Heating Source Volumes	Heating Units	Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30
Existing Heating System Operating Costs																			
Displaced electric resistance heating costs					58,547	60,889	63,324	65,857	68,491	71,231	74,080	77,043	80,125	83,330	86,663	90,130	93,735	97,485	101,384
Displaced Operation and Maintenance Costs					888	915	942	970	999	1,029	1,060	1,092	1,125	1,159	1,193	1,229	1,266	1,304	1,343
Biomass System Operating Costs																			
Green Chip Fuel ($/ton, delivered to boiler site, btu/lb) (90% of total heat rqmnt)					3,735	3,810	3,886	3,964	4,043	4,124	4,206	4,290	4,376	4,464	4,553	4,644	4,737	4,832	4,928
Small load natural gas (10% of total heat rqmnt)					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Operation and Maintenance Costs					2,664	2,744	2,826	2,911	2,998	3,088	3,181	3,277	3,375	3,476	3,580	3,688	3,798	3,912	4,030
Annual Operating Cost Savings					***53,035***	***55,249***	***57,554***	***59,953***	***62,449***	***65,048***	***67,753***	***70,569***	***73,499***	***76,549***	***79,723***	***83,027***	***86,466***	***90,045***	***93,769***
Financed Project Costs - Principal and Interest																			
Displaced System Replacement Costs																			
Special financing																			
USDA Green ton subsidy (Note 1) ($/ton, Green chip tons/year) (Notes 5&6)																			
Net Annual Cash Flow					***53,035***	***55,249***	***57,554***	***59,953***	***62,449***	***65,048***	***67,753***	***70,569***	***73,499***	***76,549***	***79,723***	***83,027***	***86,466***	***90,045***	***93,769***
Cumulative Cash Flow					***330,198***	***385,447***	***443,001***	***502,954***	***565,403***	***630,451***	***698,205***	***768,773***	***842,272***	***918,821***	***998,545***	***1,081,572***	***1,168,038***	***1,258,082***	***1,351,851***

West Bonner Junior High School

Priest River, Idaho

Date: July 1, 2010
Analyst: CTA Architects Engineers - Nathan Ratz, Nick Salmon

Option 1 A

Semi-automated
Green Wood Chips

EXISTING CONDITIONS

	#2 Fuel Oil	Propane	Electricity	
Existing Fuel Type:	gallons	galllons	kwh	
Fuel Units:	$2.32	$0.00	$0.00	
Current Fuel Unit Cost:	30,000	0	0	
Estimated Average Annual Fuel Usage:	$69,600	$0	$0	
Annual Heating Costs:				
ENERGY CONVERSION (to 1,000,000 Btu; or 1 dkt)				
Fuel Heating Value (Btu/unit of fuel):	138500	90500	3413	
Current Annual Fuel Volume (Btu):	4,155,000,000	0	0	
Assumed efficiency of existing heating system (%):	80%	80%	100%	
Net Annual Energy Produced (Btu):	3,324,000,000	0	0	3,324,000,000

WOOD FUEL COST

	Wood Chips
$/ton:	$45.00
Assumed efficiency of wood heating system (%):	65%
PROJECTED WOOD FUEL USAGE	
Estimated Btu content of wood fuel (Btu/lb) - **Assumed 40% MC**	5400
Tons of wood fuel to supplant net equivalent of 100% annual heating load.	474
Tons of wood fuel to supplant net equivalent of 85% annual heating load.	402
25 ton chip van loads to supplant net equivalent of 85% annual heating load.	16

Project Capital Cost	-$500,000

Project Financing Information	
Percent Financed	100%
Amount Financed	-$500,000
Amount of Grants	$0
Interest Rate	5.00%
Term	10
Annual Finance Cost (years)	-$64,752

-274870

Additional Power Use	
Est. Pwr Use	75000 kWh
Elec Rate	$0.080 /kWh

Additional Maintenance					
Type	Hr/Wk	Wk/Yr	Total Hr	Wage/Hr	Total
Biomass System	6.0	40	240	$20.00	$4,800
Other	0.0	40	0	$20.00	$0
1st 2 Year Learning	3.0	40	120	$20.00	$2,400

Simple Payback: Total Project Cost/Year One Operating Cost Savings:	18.0 years
Net Present Value (30 year analysis):	$243,553
Net Present Value (20 year analysis):	-$161

Inflation Factors	
O&M Inflation Rate	2.0%
Current Fuel Inflation Rate	6.0%
Wood Fuel Inflation Rate	3.0%
Discount Rate for Net Present Value Calculation	3.0%

Cash flow Descriptions	Unit Costs	Heating Source Proportion	Annual Heating Source Volumes	Heating Units	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 20	Year 30
Existing Heating System Operating Costs																	
Displaced heating costs No. 1 Fuel Oil	$0.00		0	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Displaced heating costs No. 2 Fuel Oil	$2.32		30000	gallons	$69,600	$71,688	$73,839	$76,054	$78,335	$80,685	$83,106	$85,599	$88,167	$90,812	$93,537	$122,044	$164,017
Displaced heating costs Propane	$0.00		0	galllons	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Displaced heating costs Electricity	$0.000000		0	kwh	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Biomass System Operating Costs																	
Wood Fuel ($/ton, delivered to boiler site)	$45.00	85%	402	tons	$18,112	$18,655	$19,215	$19,791	$20,385	$20,996	$21,626	$22,275	$22,943	$23,631	$24,340	$31,759	$42,681
Small load existing fuel - No. 1 Fuel Oil	$0.00	15%	0	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Small load existing fuel - No. 2 Fuel Oil	$2.32	15%	4500	gallons	$10,440	$10,753	$11,076	$11,408	$11,750	$12,103	$12,466	$12,840	$13,225	$13,622	$14,030	$18,307	$24,603
Small load existing fuel - Propane	$0.00	15%	0	gallons	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Small load existing fuel - Electricity	$0.00	15%	0	kwh	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Additional Operation and Maintenance Costs					$4,800	$4,896	$4,994	$5,094	$5,196	$5,300	$5,406	$5,514	$5,624	$5,736	$5,851	$6,993	$8,524
Additional Operation and Maintenance Costs First 2 years					$2,400	$2,448											
Additional Electrical Cost	$0.080				$6,000	$6,360	$6,742	$7,146	$7,575	$8,029	$8,511	$9,022	$9,563	$10,137	$10,745	$18,154	$32,510
Annual Operating Cost Savings					***$27,848***	***$28,576***	***$31,813***	***$32,615***	***$33,430***	***$34,257***	***$35,097***	***$35,949***	***$36,812***	***$37,686***	***$38,569***	***$46,832***	***$55,699***
Financed Project Costs - Principal and Interest					***(64,752)***	***(64,752)***	***(64,752)***	***(64,752)***	***(64,752)***	***(64,752)***	***(64,752)***	***(64,752)***	***(64,752)***	***(64,752)***			
Displaced System Replacement Costs (year one only)					***0***												
Net Annual Cash Flow					***(36,904)***	***(36,176)***	***(32,939)***	***(32,137)***	***(31,322)***	***(30,495)***	***(29,655)***	***(28,803)***	***(27,940)***	***(27,067)***	***38,569***	***46,832***	***55,699***
Accumulated Cash Flow					***(36,904)***	***(73,080)***	***(106,020)***	***(138,157)***	***(169,480)***	***(199,974)***	***(229,629)***	***(258,433)***	***(286,373)***	***(313,440)***	***(274,870)***	***113,276***	***631,451***

West Bonner Junior High School

Priest River, Idaho

Date: July 1, 2010
Analyst: CTA Architects Engineers - Nathan Ratz, Nick Salmon

Option 2 A

Pellets

EXISTING CONDITIONS

	#2 Fuel Oil	Propane	Electricity	
Existing Fuel Type:	gallons	gallons	kwh	
Fuel Units:				
Current Fuel Unit Cost:	$2.32	$0.00	$0.00	
Estimated Average Annual Fuel Usage:	30,000	0	0	
Annual Heating Costs:	$69,600	$0	$0	
ENERGY CONVERSION (to 1,000,000 Btu; or 1 dkt)				
Fuel Heating Value (Btu/unit of fuel):	138500	90500	3413	
Current Annual Fuel Volume (Btu):	4,155,000,000	0	0	
Assumed efficiency of existing heating system (%):	80%	80%	100%	
Net Annual Energy Produced (Btu):	3,324,000,000	0	0	3,324,000,000

WOOD FUEL COST

	Wood Pellets
$/ton:	$145.00
Assumed efficiency of wood heating system (%):	75%
PROJECTED WOOD FUEL USAGE	
Estimated Btu content of wood fuel (Btu/lb) - **Assumed 40% MC**	6800
Tons of wood fuel to supplant net equivalent of 100% annual heating load.	410
Tons of wood fuel to supplant net equivalent of 85% annual heating load.	349
25 ton chip van loads to supplant net equivalent of 85% annual heating load.	14

Project Capital Cost	**-$200,000**

Project Financing Information	
Percent Financed	**100%**
Amount Financed	-$200,000
Amount of Grants	$0
Interest Rate	5.00%
Term	10
Annual Finance Cost (years)	-$25,901

Additional Power Use	
Est. Pwr Use	75000 kWh
Elec Rate	$0.080 /kWh

-250275

Additional Maintenance					
Type	Hr/Wk	Wk/Yr	Total Hr	Wage/Hr	Total
Biomass System	1.0	40	40	$20.00	$800
Other	0.0	40	0	$20.00	$0
1st 2 Year Learning	1.0	40	40	$20.00	$800

Simple Payback: Total Project Cost/Year One Operating Cost Savings:	203.7 years
Net Present Value (30 year analysis):	-$266,077
Net Present Value (20 year analysis):	-$225,172

Inflation Factors	
O&M Inflation Rate	2.0%
Current Fuel Inflation Rate	6.0%
Wood Fuel Inflation Rate	3.0%
Discount Rate for Net Present Value Calculation	3.0%

Cash flow Descriptions	Unit Costs	Heating Source Proportion	Annual Heating Source Volumes	Heating Units	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 20	Year 30
Existing Heating System Operating Costs																	
Displaced heating costs No. 1 Fuel Oil	$0.00		0	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Displaced heating costs No. 2 Fuel Oil	$2.32		30000	gallons	$69,600	$71,688	$73,839	$76,054	$78,335	$80,685	$83,106	$85,599	$88,167	$90,812	$93,537	$122,044	$164,017
Displaced heating costs Propane	$0.00		0	gallons	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Displaced heating costs Electricity	$0.000000		0	kwh	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Biomass System Operating Costs																	
Wood Fuel ($/ton, delivered to boiler site)	$145.00	85%	349	tons	$50,578	$52,095	$53,658	$55,268	$56,926	$58,634	$60,393	$62,205	$64,071	$65,993	$67,973	$88,689	$119,191
Small load existing fuel - No. 1 Fuel Oil	$0.00	15%	0	0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Small load existing fuel - No. 2 Fuel Oil	$2.32	15%	4500	gallons	$10,440	$10,753	$11,076	$11,408	$11,750	$12,103	$12,466	$12,840	$13,225	$13,622	$14,030	$18,307	$24,603
Small load existing fuel - Propane	$0.00	15%	0	gallons	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Small load existing fuel - Electricity	$0.00	15%	0	kwh	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Additional Operation and Maintenance Costs					$800	$816	$832	$849	$866	$883	$901	$919	$937	$956	$975	$1,165	$1,421
Additional Operation and Maintenance Costs First 2 years					$800	$816											
Additional Electrical Cost	$0.080				$6,000	$6,360	$6,742	$7,146	$7,575	$8,029	$8,511	$9,022	$9,563	$10,137	$10,745	$18,154	$32,510
Annual Operating Cost Savings					***$982***	***$847***	***$1,531***	***$1,383***	***$1,218***	***$1,036***	***$835***	***$614***	***$371***	***$104***	***-$187***	***-$4,271***	***-$13,707***
Financed Project Costs - Principal and Interest					*(25,901)*	*(25,901)*	*(25,901)*	*(25,901)*	*(25,901)*	*(25,901)*	*(25,901)*	*(25,901)*	*(25,901)*	*(25,901)*			
Displaced System Replacement Costs (year one only)					***0***												
Net Annual Cash Flow					*(24,919)*	*(25,054)*	*(24,370)*	*(24,518)*	*(24,683)*	*(24,865)*	*(25,066)*	*(25,287)*	*(25,530)*	*(25,796)*	*(187)*	*(4,271)*	*(13,707)*
Accumulated Cash Flow					*(24,919)*	*(49,973)*	*(74,343)*	*(98,861)*	*(123,544)*	*(148,409)*	*(173,475)*	*(198,762)*	*(224,292)*	*(250,088)*	*(250,275)*	*(270,179)*	*(359,144)*