Feasibility Analysis

For

Heating Tribal Buildings with Biomass

A People of Vision

The Confederated Salish and Kootenai Tribes of the Flathead Reservation

Acknowledgements

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1. EXECUTIVE SUMMARY

1.1. BACKGROUND AND OBJECTIVES

The Confederated Salish and Kootenai Tribes of the Flathead Reservation (CSKT or Tribes) have undertaken efforts to determine if cost effective uses for biomass fuels can be developed for both existing buildings as well as future planned buildings or expansions. This effort utilized funding from the U. S. Department of Energy and a core team comprised of S & K Holding Company, Inc. (SKHC), T. P. Roche Company (TPRC), and a team of Issues Committee members (selected based on expertise as well as critical regulatory, environmental, cultural, and educational criteria.) This core team under the guidance of the CSKT Tribal Council has developed this feasibility analysis. This analysis' intended purpose is for use as a decision making tool in order to further the effective use and development of Tribal infrastructure utilizing biomass as a resource.

A kick-off meeting was conducted at the onset of project activity on January 7th. This provided the Issues Committee members a chance to meet Jack Whittier of McNeil Technologies and to ask questions and to voice concerns about the project. An additional Issues Committee meeting took place in March, the last meeting that included McNeil Technologies as the technical contractor on this project. McNeil Technologies also conducted two data gathering trips to Montana. In June, SKHC contracted with T. P. Roche Company (TPRC) to complete the feasibility study. Tom Roche of TPRC came to the Flathead Reservation and met with the Issues Committee in June. In addition to that kick-off meeting (June 25-27), two additional data gathering and project team meetings in Montana by TPRC were conducted, one in late August and one in late October.

SKHC initially contracted with McNeil Technologies to provide a feasibility assessment for utilizing biomass to heat Tribal buildings. After default on the contract, TPRC was engaged to assist SKHC with the biomass utilization feasibility assessment.

Project scope included completion of the study, preparation of a final report summarizing the results of the project and presentation of our findings and recommendations to the CSKT Tribal Council and at the annual DOE Tribal Energy Program review in Denver, CO in November, 2008.

1.2. PROJECT DESCRIPTION

The project included addressing the following issues:

- Biomass Fuel Availability - Determine the availability of waste wood from Tribal Forestry operations and area wood processing businesses to satisfy potential demand for biomass materials for heating Tribal buildings.
- Demand Analysis - Identify and assess potential biomass heating applications at existing and planned Tribal buildings.
- Technology Assessment - Identify the "best" technology for the candidate existing and planned buildings based upon cost, reliability, operating ease, building requirements and available fuel characteristics.
- Economic Viability - Evaluate the economic viability of the potential opportunities with a pro forma economic model.

- Regulatory Compliance and Cultural Compatibility - Address compliance with applicable federal, Tribal, and state regulations affecting biomass utilization. With Tribal foresters and the cultural committees' input, determine if biomass utilization will have adverse or positive environmental and cultural impacts.

1.3. CONCLUSIONS

Fuel Supply

Existing wood manufacturers in the valley currently produce enough waste to easily fuel the candidate existing and planned buildings. Current prices are typically less than $8 per green ton plus transportation. Existing and planned tribal buildings that are candidates to be heated with biomass are located near potential fuel suppliers. Delivered cost of biomass fuel from these sources could be as low as $15 per green ton. However, it is difficult to predict the availability of the supply of waste biomass material from these sources in the future.

Tribal Forestry operations generate approximately 14,000 tons per year of slash material, more than enough to fuel heating of existing and planned candidate buildings. Expectations of slash volume generated by Tribal Forestry, range from 10,000 tons to 30,000 tons annually. This material is currently either piled and burned or ground into hog fuel.

In populated areas, particularly on the east side of the valley along the Mission Range, air pollution from slash burning is a problem. Burning of slash piles is closely monitored. Smaller piles are burned over longer periods of time than in less populated areas. In the more remote areas, particularly on the south and west sides of the Reservation, slash burning is less of a problem.

In addition to burning slash piles, Tribal Forestry also has contracts with grinders to remove waste biomass. Material that is close to a logging road is ground to hog fuel, loaded into trailers and hauled to Smurfit Stone Container in Missoula. Economic considerations prevent slash piles too far from the logging roads from being utilized in this manner. Logging roads often need to be upgraded and maintained to accommodate tractor trailer rigs equipped as chip vans, adding further costs and reducing the percentage of logging residue that can be economically ground to hog fuel.

Analysis has determined that hog fuel is not a satisfactory fuel for heating tribal buildings. Hog fuel derived from slash grinding presents a problem for the fuel handling systems associated with building heat scale operations. The grinder produces an inconsistent product, including material too large and some too stringy for a small scale biomass boiler fuel handling system. In addition, hog fuel from a tub grinder typically contains needles, dirt, and rocks, causing ash fusion problems. Dirt causes excessive ash formation and also ash fusion. Rocks are a problem for the fuel delivery system and also cause problems in the fire box. Therefore, using slash as a fuel supply for building heat requires careful handling of the slash material to avoid contamination with dirt and rocks. Waiting a year before chipping a slash pile allows time for the needles to naturally fall off. Also, chippers can be equipped with a port or opening in the discharge chute so that most of the needles can be eliminated from the product. By using a chipper instead of a grinder and by the operator taking care to avoid dirt and rocks, both of these problems associated with hog fuel can be minimized.

Candidate Buildings for Biomass Heating

Of the existing candidate buildings, only the Two Eagle River School in Pablo is currently a viable candidate for heating with biomass material. The St. Ignatius Health Center could be a candidate for heating with biomass material when the building is expanded.

Planned buildings have potential for an additional demand of 1200 to 3400 tons per year of biomass material. Virtually all of the potential additional biomass demand for heating buildings is located along Highway 93, from Polson to St. Ignatius.

Technology

Based upon fuel compatibility, project size, technical support, number of successful applications and regional presence, Chiptec and Messersmith were identified as the leading technology supplier candidates. Based on a combination of factors, we chose Messersmith technology for purposes of economic modeling. Application of Messersmith technology is more prevalent in the region; existing regional project operators expressed a higher level of satisfaction with Messersmith. Existing system operators report that Messersmith provided a higher level of support during installation, start-up and operation.

Project Economics

Capital cost and financing terms are the two most important factors effecting project economics. This project, like most "fuels for schools" projects, requires some capital cost subsidy to be economically justified. Economic modeling and sensitivity analysis demonstrates that the project can be expected to save over $27,000 per year at Two Eagle River School and payout in less than 10 years.

1.4. NEXT STEPS

As a result of this feasibility study, S & K Holding Company has identified two initiatives that warrant immediate action. The first is proceeding with installation of a Messersmith biomass-fired heating system at Two Eagle River School. This initiative will include the following steps:

- Engage engineering company to prepare detailed design package, including project cost definition and implementation schedule;
- Identify and apply for grants to reduce the project capital requirements to a level where the project has acceptable return on investment and payout period;
- Contract for sale of green credits to further reduce capital requirements;
- Identify and secure attractive project financing.

The second initiative is to utilize slash residue from Tribal forestry logging operations to develop a wood chip supply business. In addition to Two Eagle River School and future Tribal construction, potential customers for wood chips include Thompson Falls School and Glacier High School. Additional capacity will also allow for delivery of pulp grade or high grade fuel to Smurfit Stone Container at a premium price. This initiative will include the following steps:

- Identify and apply for grants to fully assess business opportunity (market size, revenue potential, employment, equipment needs)

- Identify and apply for grants to reduce the capital requirements to a level where development of the business has acceptable return on investment and payout period;
- Identify and secure attractive financing for equipment purchase.

2. BIOMASS SUPPLY

2.1. INTRODUCTION

Annual planned timber harvest on Tribal lands is approximately 14 - 16 million board feet per year. Substantial non-merchantable material is produced. The non-merchantable material encompasses logging slash, small diameter trees from pre-commercial thinning operations and small diameter trees from forest restoration and fire mitigation activities.

Working with the Tribal Forestry Department, it has been determined that the capacity for supplying non-merchantable material to satisfy potential demand for biomass material for heating Tribal buildings. In addition, we assessed the potential for local forest products manufacturing operations to provide waste wood as fuel for Tribal heating applications and determined the costs associated with bringing the fuel material to candidate sites.

Location, production history, current market or disposition, and potential participants in supply chain (loggers, grinders/chippers, and truckers) were documented for each candidate fuel supply.

2.2. WOOD PRODUCTS MANUFACTURERS

Candidate area wood product manufacturers that are potential supplier of fuel to heat Tribal buildings include:

- Plum Creek Timber Company - Pablo
- Hunts Timbers – St. Ignatius
- Western Bee - Polson
- Dupuis Lumber Company - Polson
- Foothill Post & Lumber, LLC. – St. Ignatius
- Flathead Sticker and Lath, Inc. – Pablo

Plum Creek Timber Company – Pablo

Plum Creek's mill is located in Pablo, just south of S&K Holding Company's office on Highway 93. Most of their waste biomass material is already being used. Plum Creek uses the hog fuel they generate on site. Stone Container in Missoula purchases Plum Creek's chips, and the sawdust is trucked to Columbia Falls to make medium density fiberboard (MDF). Occasionally, Plum Creek has some bark available, but is not considered a viable supply due to conflicting internal demand.

Hunts Timbers – St. Ignatius

Hunts Timbers manufactures timbers and fence poles. The facility is located on Highway 93, north of St. Ignatius. Hunt Timbers has existing customers for most of their waste

biomass material. They have about 100 tons per year of bark and range between 100 to 200 tons per year of peeler shavings that could be available as a fuel for heating Tribal buildings. The Hunts Timbers facility is about 14 miles south of Pablo on highway 93.

Western Bee – Polson

Western Bee produces bee hive containers in Polson. The company uses their waste product to produce residential grade pellets. The owners have no interest in investing to expand their pellet production operations. Western Bee currently produces enough pellets for local customers, mostly residential accounts. The nearest alternative supplier of pellets is a wholesale supplier in Eureka, over 100 miles away.

Western Bee has little residues (about 1 truckload per week of kindling grade material) which are currently being taken to the local dump.

Dupuis Lumber Company – Polson

Dupuis Lumber is located three miles east of Polson. The facility can process logs up to 41 feet long and generates over 6 tons of green waste per week (about 2500 pounds per day of slab, five days per week, year round). The waste biomass material is in the form of slabs (the rounded perimeter part of the log). Dupuis Lumber has been paying John Jump Trucking $100 per truckload to come to the plant, grind the slabs and haul off the material that is generated from their operations. The company recently acquired a used chipper, but still pay to have waste biomass material removed from their site. Based upon the experience of the Darby and Victor schools with this type of fuel, it is believed that the chipped slab material is an excellent fuel for the type of biomass burner being considered. The Dupuis Lumber facility is about 8 miles north of Pablo, the location of Two Eagle River School.

Foothill Post & Lumber, LLC. – St. Ignatius

Foothill Post & Lumber, LLC is located about five miles northeast of St. Ignatius and three miles east of highway 93. The owner is a strong supporter of the community and is interested in providing their waste biomass material to heat Tribal facilities. The operations produce two biomass waste materials: 1) wood chips and saw dust from timber manufacturing and sawmill (50 trailer loads per year, 27 tons per load) and 2) peelings from fence pole manufacturing (175 trailer loads per year, 34 tons per load). Both materials are currently stored on site in 53 feet long trailers provided by Smurfit Stone in Missoula. Samples of both materials were sent to Messersmith (a preferred equipment vendor) for evaluation. Messersmith determined that the chipped material is an ideal fuel and that the peeler material is also a satisfactory fuel for the fuel handling system and fire box. Smurfit Stone pays $8 per ton and hauls the material to its mill in Missoula (approximately 40 miles away). The Foothill Post and Lumber facility is about 22 miles south of Pablo.

Foothill Post & Lumber, LLC – St. Ignatius (1)

Foothill Post & Lumber, LLC – St. Ignatius (2)

Foothill Post & Lumber, LLC – St. Ignatius (3)

Foothill Post & Lumber, LLC – St. Ignatius (4)

Flathead Sticker and Lathe, Inc. – Pablo/Ronan

Flathead Sticker and Lathe, a Tribal enterprise manufacturing posts and poles located in Pablo, ceased operations during 2007. All doweling equipment is being retained by the Tribes and has been transferred to Tribal Forestry. Tribal Forestry is relocating the equipment to a Forestry Operations site and plans utilize the equipment under a new business entity. This business is expected to generate 5 to 10 dry tons of biomass waste per day. In past operations, waste biomass (primarily peelings and chips from doweling and capping operations) were sold to local ranchers as bedding material at $20 per truckload, or disposed of in the local area as fill material. The waste biomass material is anticipated to be similar in quality to that from Foothill Post & Lumber. The anticipated site of the relocated Flathead Sticker and Lathe facility is near Ronan, about 5 miles south of Pablo.

Other Potential Suppliers

Additional wood product manufacturers exist on the Reservation in the form of log home manufacturers, additional post and pole operations, and other small manufactures of wood based products. Collectively, these suppliers have been excluded from this study due to a variety of reasons.

Four log home manufacturers currently operate on the reservation. Log home manufacturers produce their products from lodge pole pine and preferable spruce. Experience from existing fuels for schools programs have indicated that spruce is not a good fuel for biomass fueled boilers. Although lodge pole pine works well, requiring a separation of waste material by these manufactures is not feasible.

Two additional post and pole yards exist. One located in Niarada has contemplated closing operations and is already on limited production. The second is tooling up and hoping to start operations in 2009 but has no production experience to identify potential biomass waste residues. This second operation may become a viable source of fuel in the future. It is located near Charlo, approximately 15 miles from Pablo.

A number of small wood product manufactures operate on the Reservation. These include a shim business in Pablo, a furniture manufacturer in Pablo, a second furniture manufacturer in Ronan and a variety of small businesses in the St. Ignatius and Arlee areas. The amount of residues produced by the businesses is not significant enough to be considered a consistent source of fuels for this program.

2.3. TRIBAL FORESTRY OPERATIONS

Another potential source of biomass supply to heat tribal buildings is the residues from Tribal Forestry operations. The Tribes updated their Forest Management Plan in the year 2000, creating a 30 year management plan. The purpose of the forest management plan is to provide long-term direction for the wise use and management of forest resources, and to manage those resources in a renewable manner. Ecosystem management is an integral part of the plan. Ecosystem management incorporates ecological, cultural, economic, social, and managerial principles to maintain and restore the ecological diversity and integrity of the forest. The plan was prepared with much input from the Tribal membership. In addition to half a dozen public meetings and meetings with the Tribal culture committees and

the Tribal Council, the forest plan team worked over the course of several days with an Ad Hoc group of Tribal members appointed by the Tribal Council. The concerns of the Tribal public and the Ad Hoc group played a major part in shaping the plan.

The interactions of plants and animals and natural processes — fire, insects, disease, flooding, windthrow —is reflected in the plan.

"These Mountains belong to our children, and when our children grow old they will belong to their children. In this way and for this reason, these mountains are sacred."

— Flathead Culture Committee, 1977

The Reservation has been divided into six landscapes based on physical features such as topography, soils, geology, climate, watersheds, vegetation types, and administrative designations. The six landscapes are identified in the figure below.

The Flathead Indian Reservation, which makes up the lower quarter of the Flathead River Basin, encompasses 1.3 million acres. About a third of that area, some 459,408 acres, is forested. Most of these timbered acres are on the hills and mountains along the perimeter and central portions of the Reservation and represent the bulk of the Tribal land base.

The forests of the Reservation are typical of the northern Rocky Mountain region. Ponderosa pine, Douglas-fir, Western larch, Lodge pole pine, Grand fir, Engelmann spruce, Subalpine fir, Whitebark pine, and Alpine larch are the most common trees.

Without disturbance like fire or logging, stand density has increased substantially over what it was during pre-European times. The availability of moisture, nutrients, and light limit the number of trees that can grow on each site, so as trees become more crowded, stresses increase due to competition. As stresses increase, trees become more susceptible to attack

by insects and disease. Those agents kill trees. The result is a buildup of fuels giving rise to larger more destructive fires. The plan recognizes that without a change in management practices, extreme disturbance events will become inevitable. On the Flathead Reservation, with the number of people living in or adjacent to the forest and with the current unnaturally high fuel conditions, fire can no longer be expected to play its historic role in ecosystem processes. While fire suppression policies may change in some special management zones, wildfires occurring in most areas will have to be managed under existing policies for the foreseeable future.

The ecosystem management actions contained in the management plan — a combination of timber harvest, pre-commercial and commercial thinning, and prescribed fire — are designed to restore the forest, not all the way back to its pre-European condition, but to move it in a more ecologically sustainable direction, one that more closely resembles the pre-European.

Industrial timber harvest began on Reservation forests around the turn of the century and has continued to the present. Average annual harvest of saw logs has been 29.1 million board feet (MMBF) since 1911.

Since wildfires have been effectively excluded in modern times, actual harvests have been less than what the forest is growing, thus forest stocking has increased.

The Tribes developed an EIS for the 2000 Draft Forest Management Plan. The EIS evaluated three ecosystem management alternatives, each with its own harvest schedule. At one end of the continuum was an aggressive ecosystem restoration alternative, at the other, a commodities emphasis alternative.

The Annual Allowable Cut (AAC) estimate of 18.1 million board feet (MMBF) was presented in the *Flathead Forest Management Plan: Final Environmental Impact Statement (FEIS).* It is an estimate based on an average yield occurring during the short-term projection period, or first 30 years. This estimate will be refined during revisions of the *Flathead Inventory Analysis* (which occurs about every ten years) or more often if needed. The AAC is based on short-term harvest projections or the average volume estimated to occur during the first 30 years of the projection period.

The actual annual timber harvest is approximately 15-16 MMBF per year. Substantial non-merchantable by-product material is generated. According to the Montana Department of Natural Resources an estimate of 0.87 tons of biomass is available for use from each MBF (1,000 board feet) harvested. This includes the amount of biomass available for utilization/removal after considerations for the optimum amount of woody debris retained on site for nutrients, soil structure, and wildlife habitat are met. At the current harvesting rate this is about 14,000 tons per year. At the Annual allowable Cut rate of 18.1 million board feet per year, approximately 15,700 tons per year of usable material would be generated. The non-merchantable material encompasses logging slash, small diameter trees from pre-commercial thinning operations and small diameter trees from forest restoration and fire mitigation activities. S&K Tribal Forestry management report that they could easily supply 1000 tons of chips per year to heat tribal buildings.

In 2006 and 2007 the Tribes contracted out 14,000 tons of slash for grinding to local contractors, while in 2008 the Tribes contracted out just over 28,000 tons. This was also an

extremely high quantity year for saw logs with the salvage sales after the huge fires of 2007 created an unusual opportunity that resulted in 30 MMBF of timber being harvested. It is expected that Forestry operations will typically see about 14,000 green tons of slash per year. Local contractors are grinding the slash which is then shipped to Smurfit Stone Container and sold as "hog fuel". The Tribes receive $0/ton - $1/ton for the biomass. The grinder receives $32/ton from Smurfit Stone and must cover transportation costs.

Grinder operations at the Camas location (in the west landscape) produced an average of six trailer loads per day. Each trailer holds 30 tons of the biomass. At the Camas operations, an excavator is used to gather hand piles into larger piles close to the logging road (where the grinder and trailer can access the material). Excavator fuel use makes it unfeasible to extend slash collection more than 300 feet from logging roads. Therefore, much fuel is left behind to be burned.

Camas Operations (1)

Once the material is collected in large piles near the logging road, an excavator picks up material from the pile, gives it a few shakes to remove rocks and dirt before placing them into a Universal tub grinder. From the grinder, the material is blown directly into trailers. The grinder can be equipped with smaller or larger screens depending upon desired fuel

size. The contractor has established that a maximum distance of 60 miles for transportation to market is the limit for this operation.

Camas Operations (2)

Camas Operations (3)

Camas Operations (4)

The slash produced from logging and forest management that is not ground to hog fuel is disposed of by supervised burning of slash piles. Because of the additional cost to access material far from logging roads, contractors cannot collect, grind and haul this material to market and make a profit. Other factors such as slope and terrain features also limit the capability to forward material to logging roads for grinding.

Residues from forestry operations could easily generate enough biomass fuel to heat numerous tribal buildings. Alternatively, forestry operations generate enough residue material to supply a 1-MW electrical generation plant.

The experience of others in Montana using biomass material to heat buildings suggests that hog fuel is not suitable as fuel for systems designed for this scale. A cleaner material, with

more uniform size works best with fuel handling systems and creates fewer ash problems in the fire box (discussed in technology section). For residue from logging operations to be a viable fuel supply for building heat, a more selective chipping process needs to be used instead of the current hog fuel grinding process. Boulder County, Colorado Parks and Open Space collects residues from forest management of county park land, chips the slash material into "roll on" boxes and hauls the boxes to their Messersmith heating system in Loveland, CO.

Boulder County Operations (1)

Boulder County, Colorado Parks and Open Space have a biomass energy system to heat the Parks and Open Space and Transportation complex in Longmont, Colorado. The biomass energy system uses wood byproducts, or wood chips, from natural resource management activities on Open Space properties. While Boulder County does not conduct commercial harvest of timber, they do regular thinning to promote forest health and reduce the risk of forest fires. This has been an ongoing practice for the county. Prior to installation of the biomass heating system, the thinned material was mostly piled and burned in the woods. To ensure that the fuel was free of rocks and dirt, extra care in handling of the material in the woods is required.

Boulder County Operations (2)

The facility uses approximately 650 tons per year of biomass fuel. In the past, thinned whole trees were chipped directly into 30 cubic yard roll off containers. The operation used four containers and one truck. More recently, the county has found it more economical to transport the material in 180 cubic yard live floor trailers. It is significantly cheaper to contract for transportation in the larger trailers. However, the smaller containers are still used in areas that cannot be accessed by the larger trailers.

Cost for chipping and transportation are reported to be about $26 per ton, with $14 per ton attributed to transportation. This cost estimate includes amortization of equipment. The cost of thinning and collecting in piles for chipping is not included in the fuel cost, as these costs would be borne by forest management operations in any event. Wood chips transportation is 42 miles (one way). The transportation cost of $14 per ton for an 84 mile round trip haul is about $5.00 per mile.

The trailers are unloaded directly to clean storage areas (either directly to the fuel storage building or to a clean outside storage adjacent to the facility). The storage bin is large enough to hold about a 2 week supply of wood chips. Since the county primarily harvests in the summer and use fuel in the winter, additional fuel storage is required. A front end loader is used to transfer biomass fuel to the fuel storage building from the adjacent outside

storage area. The Boulder County, Colorado Parks and Open Space operator emphasized that fuel quality is very important. Their wood chip fuel is derived from "whole tree chipping". Overall, Boulder County, Colorado Parks and Open Space burns about five tons per day and generate about one wheel barrow of ash.

S & K Forestry operations generate more than enough slash material to replicate the Boulder County fuel supply strategy. Local contractors have provided the following transport cost information (based on a 65 mile one way haul – the longest haul required from any location on the Reservation):

- Butch Barber Trucking - $100.00 per hour. No mileage fee.
- Hanson Trucking - $519.18 per load ($17.33 per ton) with up to one hour load time included. Additional time for loading would be charged at $65.00 per hour.
- Johnson Trucking - $2.25 per mile (both directions).

Hanson Trucking's bid of $17.33 per ton for a 65 mile delivery is comparable to Boulder County's experience of $14 per ton for a 42 mile delivery. Johnson Trucking's cost of $2.25 per mile is significantly less than Boulder County's experience of about $5.00 per mile. The difference might be explained by the fact that Boulder County is transporting some portion of their supply in 30 cubic yard containers.

By collecting slash for fuel, Forestry would avoid the costs for slash burning. Typically this cost is $10 per acre, although it can be higher (as much as $100 per acre) depending upon proximity to population centers or if the location is where the smoke impacts elderly, children, or people with respiratory problems. In those circumstances, fewer slash piles can be lit at a time to reduce the total smoke generated.

To replicate the fuel collection process employed in Boulder County, Colorado, the Tribes would need additional equipment. In this case, hook lift containers would be used to transport slash to "landings" near logging roads where the chipper and live bed trailers can be positioned. Bids were obtained for the required equipment to determine the cost and economic viability of utilizing this material to heat Tribal buildings.

- A Morbark 30/36 drum chipper with conveyor feed deck and onboard grapple - $278,500. This chipper is capable of end loading a 42 foot long chip van in 30 minutes.
- Three live floor chip vans - $50,000 each for a total of $150,000.
- Three used tractors to pull vans - $20,000 each for a total of $60,000.
- A used tractor to transport hook lift containers, retrofitted with Stellar hook lift -$45,000.
- Four hook lift containers (24'x10'x8') custom made in Missoula $16,000 each for a total of $64,000.
- Used forwarder (Timbco) with retrofitted Stellar Hook system - $200,000.
- Steerable pup trailer set up for moving hook-lift containers - $45,000.

This slash harvesting / chipping system will produce a higher grade chip than tub grinding that would be suitable for biomass boilers and also provide a higher value chip for material that is not consumed by Tribal requirements.

2.4. Summary and Conclusions

Existing wood manufacturers in the valley currently produce enough waste to easily fuel the planned buildings. However, it is difficult to predict what the supply of waste biomass material availability from these sources will be in the future. These businesses could fail. Competition for the material could drive the price up. Internal projects to utilize the material could take it off the market.

Tribal Forestry operations generate approximately 14,000 tons per year of slash material, more than enough to fuel heating of existing and planned candidate buildings. Tribal Forestry operating plans call for sustainable management of the Tribal forest lands. This sustainable management practice is expected to result in continued generation of slash material. Expectations of slash volume range from 10,000 tons to 30,000 tons annually. This material is currently either piled and burned or ground into hog fuel.

Tribal Forestry operations are primarily along the edge of the mountain ranges in the Missions Landscape and to the top of the mountain range to the Tribal border in each of the other landscapes. In populated areas, particularly on the east side of the valley along the Mission Range, air pollution from slash burning is a problem. Forest thinning is critically important in the areas close to populated areas for fire protection. Burning of slash piles is closely monitored. Smaller piles are burned over longer periods of time than in less populated areas. In the more remote areas, particularly on the south and west sides of the Reservation, slash burning is less of a problem.

In addition to burning slash piles, Tribal Forestry also has contracts with grinders to remove waste biomass. Material that is close to a logging road is ground to hog fuel, loaded into trailers and hauled to Smurfit Stone Container in Missoula. Economic considerations prevent slash piles too far from the logging roads from being utilized in this manner. Logging roads often need to be upgraded and maintained to accommodate tractor trailer rigs equipped as chip vans, adding further costs and reducing the percentage of logging residue that can be economically ground to hog fuel.

Analysis has determined that hog fuel is not a satisfactory fuel for heating tribal buildings. Hog fuel derived from slash grinding presents a problem for the fuel handling systems associated with building heat scale operations. Instead of producing a relatively consistent wood chip, the grinder produces a wider range of product size, including some too large and some too stringy for a biomass boiler fuel handling system. In addition, hog fuel from a tub grinder typically contains needles, dirt, and rocks. As discussed in Section 4, needles are high in alkalinity and cause ash fusion problems (creation of clinkers). Dirt causes excessive ash formation and also ash fusion.

Rocks are a problem for the fuel delivery system and also cause problems in the fire box. Therefore, using slash as a fuel supply for building heat requires careful handling of the slash material to avoid contamination with dirt and rocks. Waiting a year before chipping a slash pile allows time for needles to naturally fall off. Also, chippers can be equipped with a port or opening in the discharge chute so that most of the needles can be eliminated from the product. By using a chipper instead of a grinder and by the operator taking care to avoid dirt and rocks, both of these problems associated with hog fuel can be minimized. However, the cost of the fuel then increases.

"Clinker"

3. DEMAND ANALYSIS

3.1. INTRODUCTION

A number of biomass resource heating applications at existing and planned buildings were evaluated. For identified existing candidate buildings, the team assessed fuel consumption and current heating technology and potential for retrofit to a biomass system. Building upon completed work, buildings were ranked based upon their suitability for retrofitting for biomass heating. Issues considered were:

- Cost and complexity of retrofitting
- Fuel delivery and storage space
- Visual impact considerations

For planned buildings, assessments of estimated peak and annual thermal demands plus site fuel storage capabilities were considered.

3.2. CANDIDATE EXISTING BUILDINGS

Candidate existing buildings include:

- Tribal Forestry Department Greenhouse
- St. Ignatius Tribal Health Facility
- Best Western KwaTaqNuk Resort
- Kicking Horse Job Corps
- Two Eagle River School

Tribal Forestry Department Greenhouse

Tribal greenhouse operations are located in rural Ronan. Approximately 18,500 square feet is enclosed. The operations are dedicated to raising native plants. The plants require a dormant state in the winter, so the greenhouse facility as currently operated, does not utilize winter heating and is subsequently not a good candidate for biomass fired heating.

St. Ignatius Tribal Health Facility

St. Ignatius Tribal Health Facility is located in St. Ignatius. These buildings consist of a 24,668 square feet one story health building and an adjacent 6,525 square feet two story administration building. The health center is five miles from Foothill Post and Lumber, LLC, making it an ideal location from a fuel transportation perspective. The center was built in the late 1960's – early 1970s period with the adjacent administration building constructed in the 1980s. Originally, the building heat and hot water systems were fueled by heating oil. The building heat was a hot water, radiator system. The health center heating system has been retrofitted and the building is now heated by six roof mounted propane heaters with individually zoned air duct systems.

St. Ignatius(roof mounted propane heater)

The administration building utilizes two roof mounted propane heaters with individually zoned air duct systems. Heating the two buildings uses an average 18,000 gallons of propane per year. The boiler room was torn apart and there are plans to remove the old, oil-fired boilers. All the radiators have been pulled from the rooms. The hot water heating distribution piping is still in place in a crawl space beneath the building. However, the pipes are galvanized steel, quite rusty and not usable. There is relatively new copper piping for potable water needs.

St. Ignatius Boiler Room (1)

Retrofitting the building to accommodate a biomass system would require extensive piping. The existing boiler room could be cleared of old equipment and would be large enough to house a biomass fired boiler and control systems. There is space available outside the old boiler room to accommodate fuel handling and storage. Extensive piping would be required to connect a new hot water distribution system to each of the six zoned air duct systems. Since the propane heaters do not have to be replaced, it would be difficult to justify the investment in a biomass retrofit at this time.

St. Ignatius Boiler Room (2)

A large expansion is planned for the health center within the next 6 years. As part of the expansion it might be easier to justify the expense of retrofitting to accommodate biomass fired heating for the health center.

Best Western KwaTaqNuk Resort

The Best Western KwaTaqNuk Resort is located on the south end of Flathead Lake in Polson. The hotel has a central utility room that houses heaters for the central section and east wing, and water heaters for the east wing and kitchen. It also has two smaller utility rooms, one housing propane fired hot water heaters for the west wing and one with a hot water heater for the pool and spa. The west wing rooms have electric heaters.

There is no room to add additional equipment in the main utility room. Space is also limited in the west wing utility room. The hotel property has limited space for a biomass boiler and fuel handling system. Access for trucks supplying fuel is also a problem. The only space that could be considered as having potential would require placing operations (and the exhaust stack) adjacent to the main entrance of the hotel and in view of some of the rooms.

Best Western KwaTaqNuk
(utility location below / Resort entrance above)

Converting to a biomass fired utility for the hotel would significantly reduce the natural aesthetic appeal of the resort. In addition, retrofitting potential is limited to heating the center and east wing without significant piping and equipment replacement. For these reasons, the KwaTaqNuk Resort was judged to have little potential for biomass heating application.

Kicking Horse Job Corps

Kicking Horse/Job Corps is a campus of buildings located about 5 miles south of Ronan. There is no central utility system. Rather, each building is equipped with its own heating system. Buildings have propane, fuel oil, or electric roof mounted systems. Other buildings have propane or electric space heaters mounted near the ceilings. The cost to replace the individual heating systems with a central system would require installing buried steam piping throughout the campus. Estimated cost of the underground, insulated piping is $200 per linear foot installed. With the students doing the work, the cost could be reduced to $75 per linear foot.

Kicking Horse Job Corps Campus (part of)

The kitchen load is too small for a stand-alone wood chip fired heating system. The kitchen heating needs could possibly be covered with a pellet system. The dorms are heated with a new “air to air” heat pump system. The dormitories have recently been remodeled. The

gymnasium is heated with a propane system. Retrofitting the gymnasium to a wood chip system is potentially viable. There is space and access for equipment and fuel delivery. However, the gymnasium is 20,000 square feet, about one half the size of Two Eagle River School. Although it has some potential for biomass heating application, it is too small to be considered economically attractive. For these reasons, it was decided not to pursue a biomass heating project at the Kicking Horse Job Corps campus at this time.

Kicking Horse Job Corps Gymnasium

Two Eagle River School

The Two Eagle River School is located in Pablo. The school is 43,500 square feet. The building has a forced air heating system. There are two heaters located in a utility room next to the gymnasium on the northwest side of the building. An electric boiler is used to provide building heat. A fuel oil boiler is used as a backup. Hot water from the boiler is piped up one level to an exchanger located in the forced air system duct. The hot water system heater utilizes fuel oil. Retrofitting the building to utilize biomass for heating would result in a demand of approximately 400 tons per year of wood chip fuel.

Two Eagle River School (front entrance / parking)

Retrofitting Two Eagle River School to a wood chip system is potentially viable. There is space and access for equipment and fuel delivery on the northeast side of the building, very close to where connections to the existing heating and hot water systems would be made, requiring very little new piping. There is a propane tank that may need to be moved. In addition, there is a buried 12,000 gallon oil tank that also may need to be removed. Currently, there is a small access road behind the school leading to the area near the heating and hot water utility connections. A new driveway is planned for the school that would provide the project ideal access for fuel delivery trucks.

Two Eagle River School (proposed site behind school)

Existing fuel demand from candidate buildings is summarized on the following tables. For Two Eagle River School, the electric demand shown on the table includes electricity used to heat the building plus lighting use and other non-heating use. To determine how much electric use could be avoided by heating with biomass, electricity used in non-heating months was subtracted from total electricity used during heating months to estimate the electric load associated with building heating.

TWO EAGLE RIVER SCHOOL (43,500 sq ft)

Electrical Usage

	2008 KWH	2007 KWH	2006 KWH	2005 KWH	2008 Cost	2007 Cost	2006 Cost	2005 Cost
January	72,720	59,760	91,200	68,640	3846.15	3096.04	4559.36	3594.32
February	89,880	82,200	96,480	50,880	4595.96	4479.42	4893.40	2642.33
March		135,960	90,360	48,720		6551.05	4518.66	2516.91
April		75,360	108,720	51,480		4089.32	5290.42	2632.95
May		73,920	59,400	46,800		3877.00	3401.81	2435.00
June		43,560	49,440	51,000		2282.80	3110.12	2572.69
July		40,680	42,600	42,840		2021.10	1714.18	2215.54
August		42,000	37,920	37,800		2216.28	1967.00	1970.49
September		51,120	43,800	54,240		2619.42	2958.01	2713.19
October		56,160	66,600	63,720		2966.45	3401.73	3803.81
November		79,800	65,760	100,440		4240.06	3625.36	5120.81
December		81,240	52,800	108,360		4265.64	2773.52	5377.03
TOTALS	59,760	821,760	805,080	724,920	$8,442.11	$42,704.58	$42,213.57	$37,595.07

Buildings:

KHJCC	Kicking Horse Job Corp Center
TERS	Two Eagle River School
SIHC	St. Ignatius Health Center (main and Charlo buildings)
KTNI	KwaTaqNuk Inn

				Propane		Fuel oil		Total	Wood
Facility	Main heat	Other heat	Annual $	Annual gal	Annual MMBtu	Annual gal	Annual MMBtu	Annual MMBtu	GT/yr
KHJCC			113,939	52,578	4,811	17,274	2,418	7,229	957
TERS			13,514	1,980	181	7,002	980	1,161	154
SIHC			29,965	18,402	1,684	-	-	1,684	223
KTNI			97,769	97,769	8,946	-	-	8,946	1,184

3.3. POTENTIAL FUTURE APPLICATIONS

We reviewed the Tribes' building plans to determine which planned facilities are good candidates for biomass heating. Planned construction and operations with biomass heating application for the next six years includes:

- St. Ignatius Tribal Health Center expansion
- Polson Tribal Health building
- Natural Resource Department / Forestry building
- Forestry Greenhouse application
- Cluster building complexes

- Kiln for Flathead Sticker and Lath
- SKC expansion

St. Ignatius Tribal Health Center expansion

The planned expansion of the Tribal Health Center in St. Ignatius would double the size of the facility to a total of approximately 50,000 square feet. Design of the expansion with biomass fired hot water and heating for the new areas, and at the same time, retrofitting the existing building to use biomass as well, would result in a demand of approximately 400 tons per year of wood chip fuel.

Polson Tribal Health Building

The new Tribal Health Center will be located at the top of Polson Hill on Hwy. 93, just south of Polson. It is anticipated to be approximately 50,000 square feet and would require approximately 400 tons per year of wood chip fuel if it is designed with biomass fired heating and hot water systems.

Natural Resource Department / Forestry Building

A combined NRD/Forestry Building is being proposed at the Ronan Airport near the existing greenhouses. The building is anticipated to be approximately 40,000 square feet and would require approximately 400 tons per year of wood chip fuel if designed with biomass fired heating and hot water systems.

Forestry Greenhouse application

The Forestry Greenhouse facility is currently used only for growing native species which are required to go dormant in the winter. Hence, as currently operated, the facility uses very little fuel for heating and is not a good candidate for biomass fired heating. However, it is located very near the site of the planned Natural Resource Department / Forestry building. If greenhouse operations are amended to require heating in the winter, the close proximity to the new building could afford the opportunity to build one biomass fired heating system to address the heating needs of both facilities with some economy-of-scale benefits for project economics. The new building and greenhouse could require up to 200 tons per year of wood chip fuel, depending upon future greenhouse operations.

Cluster building complexes

The Tribes are considering cluster housing complexes in the future. Sites and complex size details are not, as of yet, finalized. A cluster of buildings has excellent potential for biomass heating application. Although potential demand for wood chips is difficult to estimate at this time, each cluster would likely have an equivalent or greater demand for wood chips than the Two Eagle River School. This could result in an additional demand of 800 to 1,200 tons per year of wood chip fuel

Salish Kootenai College expansion

SKC expansion would be located on the college campus off of Hwy. 93 in Pablo. Size, timing and specific locations for SKC expansions have not been determined at this time. In addition to fuel demand and economic considerations, an assessment of biomass fired

heating system applications for the SKC campus must also consider the visual impact of fuel delivery and storage issues highly dependent on location and building use. SKC expansions could require approximately 1,000 tons per year of wood chip fuel

3.4. Summary and Conclusions

Of the existing candidate buildings, only the Two Eagle River School in Pablo is currently a viable candidate for heating with biomass material. The St. Ignatius Health Center could be a candidate for heating with biomass material when the building is expanded.

Planned buildings have potential for an additional demand of 1,200 to 3,400 tons per year of biomass material. Virtually all of the potential additional biomass demand for heating buildings is located along Highway 93, from Polson to St. Ignatius.

4. TECHNOLOGY

4.1 Introduction

The project focused on the technologies consistent with the area fuel supply infrastructure, facility demand, and local economics. The primary fuel supply that is readily available is hog fuel derived from logging operations waste and waste from area wood products manufacturing.

The team evaluated each existing candidate building to determine if the building is a viable candidate for retrofitting to heating with biomass fuel. For the best candidate building, Two Eagle River School, candidate technologies were identified and evaluated. The team consulted with the building operators to determine if operations could manage the technology conversion.

The team worked with equipment vendors to determine the applicable size and technology configuration (i.e., fuel handling, ash removal), and developed capital and operating cost estimates for the technology. Based upon a review of biomass fired heating systems installed in Montana using a fuel supply similar to what is available for heating Two Eagle River School, analysis of Two Eagle River School heating demand conducted by rem Engineering and a physical inspection of the Two Eagle River School facility by Gailyn Messersmith (President of Messersmith Manufacturing, Inc.), determined that the appropriate size system for the facility is a 2 MM BTU per hour boiler system.

4.2 Candidate Technologies

Based upon fuel compatibility, project size, technical support, number of successful applications and regional presence, Chiptec and Messersmith were identified as the leading technology supplier candidates. To evaluate the alternative technologies, the team interviewed the vendors and system operators at installations in Montana. Also included in this scope of work, team representatives inspected two Messersmith installations in Montana (Darby Public School and Victor School) as well as a unit located at Messersmith's manufacturing site in Bark River, Michigan. In addition, an inspection of a PSE system installed at Glacier High School in Kalispell which has been reported to have encountered significant operating problems during its initial year of operation was conducted. Messersmith has been contracted to design and install system improvements at Glacier. As

part of another assignment, a Messersmith installation at Boulder County, Colorado Parks Department and Chiptec systems at a hospital and veneer plant in Vermont were also inspected. The Messersmith installations are similar in many respects, with some variation in size and layout. Details of the Darby Public School, Victor School and Glacier High School site visits are presented below.

Darby Public School

Darby was the first operational Fuels for Schools assisted project in Montana, installed in 2003. Bitterroot RC&D (Tom Causton) assisted with project development. Planning began in 2001, construction began in July of 2003 and start-up was the 1st of October 2003. Engineering services were provided by CTA Architects and Engineers' Missoula office.

The operator reported that Messersmith provided a turn-key installation and their relationship/experience with Messersmith over the past 5 years has been excellent.

The system replaces individual heating systems in three schools (elementary, middle and high schools). The system is housed in a stand-alone building located on the school campus between the three schools. Underground steam piping connects the biomass fired heating system to the utility room in each school. Eight inch insulated steam lines are buried six feet underground and runs to each of the three school buildings. Two small steam-water heat exchangers were installed in the utility room for both building heat and hot water systems (including hot water for the kitchens). Because Darby runs a steam system (as opposed to hot water) an operator is required to possess a boiler operator license. They burn 3.9 tons of biomass daily to heat 100,000 square feet of buildings. The school used to burn 500,000 gallons of diesel annually. Darby paid $36/ton for wood fuel during the '07-'08 school year and spent $36,000.00. They have contracted at $40/ton for the '08-'09 school year.

Darby Biomass Operations Building

The operations required no additional staff positions; in fact one job was eliminated. That was due in part because the previous operations involved the use of 3 individual boilers. Maintenance time required has been reduced to less than two hours a month on the boilers. Before installing the Messersmith system, maintenance time required was as much as two hours a day with the 3 old boilers. The fire box is cleaned out once a week. Ash produced equals approximately 1 coffee can per ton of biomass burned. The stack has been cleaned once since start up (cleaned in 2008) and produced 1 garbage can full of ash. The stack operates at a temperature of 375° F. The only visible emission from the stack is steam during cold days. Emission testing for the facility found a concentration of 1.4 ppm of particulates in the stack discharge. For reference, the State of Montana allows 6 ppm.

Darby Biomass Operations Firebox

The facility currently is fueled with post and pole manufacturing waste (lodge pole pine), although they have operated using other fuels. Darby's experience is that the cleaner the wood chip fuel, the fewer operating problems are encountered. The fuel being burned now has 25-35% moisture content. The operator reported that the system can be adjusted to handle various moisture contents.

The storage building holds 40 tons of fuel. The floor of the fuel storage area is below grade. Biomass fuel is dumped into the storage area through two overhead doors. The doors are tall enough to accommodate a dump truck. Walking bed trailers can be accommodated as well. Fuel is currently delivered in a dump truck with extended sides. The school has been supplied by walking bed trailers in the past. The current fuel contract makes the provider responsible for keeping the storage full.

Darby Biomass Operations Fuel Storage

Darby School has served as a facility for experimentation with a variety of fuels including chipped slash piles, waste biomass from area wood product manufacturers (post and pole, log cabins), and wood pellets (both domestic and hog pellets). Domestic pellets worked very well but cost 3 times more than their current fuel. The hog pellets burned too hot and warped the grate. These pellets also created more clinkers (ash fusion), which had to be manually chipped off the grate. Chipped material from slash piles worked well if attention was paid during the collection, transportation and storage to keep the fuel free of dirt. Also,

removing most of the needles from the fuel reduces alkalinity of the fuel and greatly reduces the amount of clinker formation. This can be accomplished by letting the slash pile age before chipping (needles fall off) or by using a chipper equipped with a port opening allowing for a good portion of the needles and fines to be separated from the fuel supply.

Glacier High School

Unlike the experience for the Darby Schools the team had heard rumor of major difficulties at the newly built (2007) Glacier High School biomass fired heating operations. Based on that, a "lessons learned" tour was scheduled to determine if the problem came from the fuel or the fuel handling system..

The biomass facility placement was incorporated into the design of the new school and handsomely hidden by exterior screening walls. Based on their initial experience, the operator recommends that the system not be integrated into the school building. Instead, the school recommends that the system be housed in a stand-alone structure. During start-up, problems with operations experienced, forced full evacuation of the school in every occurrence as to comply with school policy and regulations.

Glacier High School Biomass Operations Entrance Area

The fuel storage area is a flat floor at grade. Walking bed trailers are backed into the fuel storage area. The trailer is pulled through the fuel storage area during unloading process. This unloading practice requires backing the trailer over the fuel system auger or moving the auger to the back of the fuel storage area prior to unloading. The storage area provides space for 13 tons of fuel. The school receives fuel every day or every other day during the winter months.

Glacier High School Biomass Operations Storage

Glacier used CTA Architects and Engineers for design services and PSE technology. The PSE fire box, boiler and fuel handling technology looked very similar to the Messersmith Technology. However, the operator pointed out some differences that proved to be significant.

The auger moving the fuel from the fuel storage floor was hollow with thinner ribbons and less welds than the auger used on Messersmith systems, ultimately causing the shearing of the auger at the knuckle. A stronger auger has since been installed.

Glacier High School Biomass Operations Auger

At the knuckle, there wasn't enough support or flexibility to keep the auger/knuckle from getting bent out of line and shutting down the system. Springs have been added to allow for more freedom of movement.

Glacier High School Biomass Operations Auger Knuckle

Although the fuel conveyor system and fire box configuration looked very much like Messersmith's, a few differences caused further operating problems.

- The PSE system conveyor dropped the fuel into a reservoir from which it is then "paddled" up to a hopper.

Unlike the Messersmith design, the hopper had no visual windows or electronic sensors to monitor and control the level of fuel in the hopper. Visual windows and electronic sensors have since been installed.

- In the PSE design, the fuel is augured from the hopper in a square feed duct. The auger appeared to be too small for the duct as there was too much space not in reach of the auger. Fuel jammed up in the duct, shutting down the system. Corrections are being configured and installed.

- The fire box has a flat floor with another auger for automated ash removal. With hog fuel, ash fusion takes place on the fire box floor, creating “clinkers”. The clinkers damaged the ash removal auger. With the automated ash removal system, there is not enough time elapsed to allow the ash to cool before removal from the fire box. Hot clinkers were conveyed with the ash into disposal barrels. The hot ash melted the discharge tube and caused flash fires in the ash disposal barrels.

- The air supply motors and duct work are placed right in front of the door to the fire box. This placement blocks access to the fire box for maintenance (clinker removal) and manual ash removal.

Messersmith has been engaged to install modifications and upgrades to improve system operation reliability.

Glacier High School was interested in using low cost hog fuel and requested a design that could handle that fuel. As built, the system cannot handle hog fuel. It isn't clear that, even after Messersmith's improvements, that hog fuel is a viable fuel for the system. The experience at Darby illustrates that the system works much better with clean, high quality wood chips as a fuel supply.

Hog fuel prices at Glacier High School were $30/ton delivered. Wood chips in storage during our visit to be used for system testing cost $120/ton delivered. Both single ground hog fuel and double ground hog fuel have been tested in the Glacier School system. The single ground caused the problems with the conveyor system, and as based on experience elsewhere, could be anticipated to cause excessive clinker formation and maintenance problems. The fuel supply system at the school in Eureka reportedly has a double auger fuel delivery system that is capable of handling hog fuel. The double ground hog fuel was too fine. It caused problems with combustion and the fines were passing through the stack.

Victor School

Victor school was another of the first Fuels for Schools assisted projects in Montana, installed in 2004. Here again, the chosen technology was Messersmith and the operator reported a good relationship with them, adding the appreciation of the ability of the Messersmith team to be able to make adjustments and fix issues from Michigan through the installed computer system.

The system was installed anticipating a 16,000 square foot expansion which was just completed previous to the teams visit in October of 2008. The system is a 125 HP 4MBTU unit and, like Darby, is housed in a cinderblock stand-alone building located next to the school. The system replaced a natural gas system. Victor burned an average 220 tons of biomass fuel annually previous to the completion of the expansion and anticipate the use of up to 500 tons annually in the future. The school has fuel supply contracts at $40/ton for the ’08-’09 school year.

The facility is currently fueled with post and pole manufacturing waste, although like Darby, has operated using other fuels. The fuel being burned now has 28-35% moisture content. The experience there is that the cleaner the fuel, the fewer the operating problems. The addition of teeth to their auger which takes a "bite" into the storage pile, allows use of some heavier fuels. However, problems still exist with hog fuel from slash grinding producing clinkers and rocks. The operator had heard the Philipsburg school operations have installed a device that reportedly effectively removes the rocks from the fuel.

The floor of the fuel storage area is flat, at grade, and stores 20 to 25 tons of fuel. The door of the storage building is not tall enough to allow a dump truck supply. Therefore, walking bed trailers are used for fuel delivery and fuel handling includes the use of a bobcat to push the wood to the rear of the building. Fuel has been delivered by walking bed trailers utilizing a different type of belt that experiences less freeze-up issues. The operator recommends a sub-surface storage building like at Darby, to simplify fuel delivery.

Victor School Biomass Operations Storage

Operations required no additional staff positions. At Victor, the control system incorporates an alarm which alerts maintenance personnel to a problem during afterhours and an automatic switch to the back-up system.

Ash produced equates to approximately 1 wheel barrel full a week. The operator here felt that an automated ash removal system would be of benefit. There is no permit required for operations.

Thompson Falls School

Thompson Falls School is another of Fuels for Schools assisted projects in Montana, installed in 2005. The project was designed by CTA Architects and Engineers. The chosen technology was Chiptec. The operator reported that the relationship with Chiptec has been strained due to operating problems encountered since start up.

The system was installed in a new building located next to an existing building that houses fuel oil-fired generators and piping connections. The building was originally the location of a coal-fired heating system. The new Chiptec system is a 1.6 MMBTU unit and like the Darby and Victor Messersmith systems, is housed in a cinderblock, stand-alone building. Thompson Falls burns an average 4 to 4 ½ tons per day or 400 tons of biomass fuel annually.

Thompson Falls School Biomass Operations Building

The facility is currently fueled with wood chips from a mill in St. Regis, 55 miles from the school. The school has fuel supply contracts at a price of over $80/ton for the '08-'09 school year. The chips are clean and uniform in size. The operator reported that the equipment was very sensitive to fuel quality. Their experience is that the cleaner the fuel, the fewer the operating problems.

The floor of the fuel storage area is flat and at grade. Wood chips are delivered in a live floor chip van. The chip storage area is not long enough to unload a full van without interrupting unloading to pile the chips with a front end loader. To fully unload, the chip van has to be pulled from the storage area so that the frontend loader can be used to pile chips, making more room on the floor. Unlike Darby, Victor and Glacier, the chip storage area is not equipped with an automatic loading system. Instead, a front end loader is used to transfer chips from the floor into an elevated "day bin". The day bin is equipped with an auger feed to the gasifier chamber of the Chiptec system. The operator reported that problems exist with the fuel feed system because the short distance from the bin to the gasifier chamber doesn't allow enough time to deal with clogging problems.

Although operations required no additional staff positions, the day bin must be filled manually every day.

Ash produced is approximately 1 wheel barrel full a week when the system is operating well. At the time of our visit, the system was not operating properly, as airlock leaks were allowing too much oxygen into the system. It was generating about 1 wheel barrel full a day. Ash is collected in the gasifier chamber as well as from a cyclone in the flue gas line to the stack. The stack was recently lengthened to ensure greater dispersion of emissions.

Thompson Falls School Chiptec Unit (part of)

Messersmith Manufacturing, Inc.

Messersmith Manufacturing, Inc. is located at 2612 F Road, Bark River, MI 49807. Messersmith manufactures biomass systems with capabilities ranging between 1.5 – 20 MM BTU per hour. Most Messersmith installations are within the range of 2 – 10 MM BTU per hour. Messersmith has just recently installed and are in the process of commissioning a 1.5 MM BTU per hour unit at Colorado State University. Messersmith provides a turn-key design and installation which includes operations training.

Messersmith designs systems utilizing various biomass fuel types. The main design consideration is the fuel handling system flexibility and cost vs. maintenance time. The Messersmith system is capable of handling fuel with a wide range of moisture content levels. However, it is not recommended to burning fuel with less than 15% moisture content utilizing the main design systems produced by the company.

Messersmith provided a rough estimate of the cost of $235,000 for a 2 MM BTU per hour system. This figure includes using a sectional stack (as opposed to a foundation stack). A 65 feet tall, freestanding foundation stack is estimated to add $46,000 to the budget. Equipment for a system with a boiler output of 2 MM BTU includes:

- ✓ Beam and wall as the fourth wall of the chip storage bin
- ✓ Traveling auger
- ✓ Belt conveyor with chip sorter to remove oversized fuel
- ✓ Metering bin and metering auger
- ✓ Stoker auger
- ✓ Combustor
- ✓ Hurst boiler with automatic tube cleaner and air compressor
- ✓ All breeching
- ✓ Induced draft fan
- ✓ Cyclone
- ✓ Insulated sectional stack
- ✓ Control panel

Messersmith completes the installation in 3 visits. On the first visit, all of the large equipment is delivered and the fire box and boiler are set in place. This usually takes 2 – 3 days. On the second visit the conveyors and control panel are installed and connections to the larger components are completed. Messersmith's price includes this electrical work. All of the piping is completed and water is introduced into the system before leaving from this second visit. This stage generally takes 2 – 3 weeks. The third visit is for start up, training and fine tuning. This step generally takes 1 week.

From the time the boiler is ordered, delivery and installation time is approximately 14 weeks. Messersmith recommends the chip bin be at least 50' long.

Chiptec

Chiptec is located at 54 Echo Place, Williston, VT 05495. Chiptec manufactures biomass systems with the capabilities ranging between 1.5 and 125 MM BTU per hour. The system best suited for the Two Eagle River School application is a 2 M Phoenix model.

Chiptec designs systems utilizing various biomass fuel types. As with Messersmith, main design consideration is the fuel handling system flexibility and cost vs. maintenance time. The Chiptec system is capable of handling fuel with a wide range in moisture levels (6 to 60%). However, the systems are typically designed to handle a smaller range. Based upon experience of other schools with biomass fired heating systems and discussions with Chiptec, we specified a design basis of 45% moisture content wood chip fuel. Chiptec's fuel delivery system includes a "moving wedge floor" which they claim is more reliable and robust than the "sweeping auger" system utilized by Messersmith.

Chiptec was asked to provide a rough estimate of their fees for a 2 MM BTU per hour system. To be comparable to Messersmith's quotation, this budget was to include a gasifier and boiler system, fuel handling equipment, process controls and installation and start up support. As of the publication of this report, the team has not received a quotation from Chiptec. However, based upon a review of the feasibility study conducted for the Boulder County, Colorado Parks and Open Space biomass-fired building heating system, it is expected that Chiptec's bid will be comparable to that of Messersmith.

Chiptec completes the installation in 4 visits. On the first visit, a Chiptec representative supervises the general contractor's equipment installation. On the second visit inspects the equipment installation, tests motors, etc. Chiptec price includes electrical work. The third visit is for start up, training and fine tuning. After a few weeks of operation a Chiptec representatives visits the site for final inspection.

Like Messersmith, Chiptec uses a third party to supply the boiler. Generally, Chiptec's fabrication is completed within the time period for the boiler construction.

4.3 Summary and Conclusions

Based upon fuel compatibility, project size, technical support, number of successful applications and regional presence, Chiptec and Messersmith were identified as the leading technology supplier candidates. Based on a combination of factors, the team chose Messersmith technology for purposes of economic modeling. Application of Messersmith technology is more prevalent in the region; existing regional project operators expressed a higher level of satisfaction with Messersmith. Existing system operators report that Messersmith provides a higher level of support during installation, start-up and operation, and installed cost of the Messersmith system is expected to be somewhat less (based upon preliminary quotes). Before proceeding with project implementation, we recommend obtaining firm bids and draft contract agreements with both candidate technology providers.

5. PROJECT ECONOMIC VIABILITY ASSESSMENT

5.1 Introduction

The economic viability of the potential opportunity for heating Two Eagle River School with biomass material with a pro forma economic model is evaluated below. Results were compared to operating with existing heating systems.

Internal Rate of Return (IRR) and payout period were analyzed to evaluate economic

viability of the project.

5.2 Base Case Model

The following base case assumptions were made for the economic modeling:

- On-line factor – 100% during heating season
- Plant operation labor force – no additional personnel required.
- Total investment - $500,000
- Fuel Cost - $15/ton
- No Green Credits
- No taxes or depreciation tax credits
- 100% equity financing
- No grant or capital cost subsidy
- Discount rate – 10%

With these base case assumptions, the Internal Rate of Return (IRR) associated with the project is only 1.45 % and the project has a payout period of 17 years. As with other biomass "fuels for schools" projects in Montana, it is clear that some subsidy to reduce capital requirements is required to make the project viable.

The capital cost estimate is based upon bids from an equipment vendor (Messersmith), engineering and construction cost estimates provided by rem Engineering and the experience at other similar projects in Montana.

Fuel cost estimate is based upon discussions with potential fuel suppliers. The base case assumption is that fuel will be provided from wastes generated by area wood product manufacturers. Sensitivity cases, discussed below, model the project with higher cost fuel scenarios from either area manufacturers or fuel supply from Tribal forestry operations.

Alternative heating costs for the base case were assumed to be the same as current conditions. Project economics' sensitivity to higher heating costs in the future is discussed below.

Base case assumptions for grant subsidy, green credits and financing terms were selected to demonstrate project viability without additional support.

Base case assumption for on-line factor for the heating season is assumed to be 100%. Project economic sensitivity to downtime is discussed below.

5.3 Sensitivity Analysis

The economic model was run for various scenarios to test the sensitivity of economic viability to certain assumptions. Variable considered in the sensitivity analysis included grant subsidy, capital cost, fuel cost, alternative heating costs (electricity, fuel oil, propane), financing terms, on-line factor and green credit contribution.

Grant Subsidy

This project considered the potential impact of grants, or other aid money. Montana has a "Fuels for Schools" program that has provided funding assistance to help meet capital

requirements for similar projects. Using base case assumptions for the Two Eagle River School and adding a $250,000 grant, reducing capital requirements by 50%, from $500,000 to $250,000 reduces the payout period from 17 years to 9 years and the project has an IRR of 9.79%. Reducing capital requirements by 75%, from $500,000 to $125,000 reduces the payout period from 17 years to 4 years and the project has an IRR of 22.79%. Further sensitivity case modeling assumes a 50% ($250,000) grant subsidy.

Capital Cost

To assess the impact of construction cost overruns, modeling was conducted for the project with a 20% increase in capital cost. The pay years for the project were extended from 9 years to 12 years and the IRR reduced from 9.79% to 5.71%, demonstrating the importance of controlling costs during project implementation.

Fuel Cost

Base case assumptions were adjusted to reflect a 50% grant subsidy ($250,000) for the Two Eagle River School project, to illustrate the importance of fuel cost. By increasing fuel cost from $15/ton to $30/ton, payout period was extended from 9 years to 11 years and IRR was reduced from 9.79% to 6.65%.

Alternative Heating Costs (electricity, fuel oil, propane)

Base case assumptions were again adjusted to reflect a 50% grant subsidy ($250,000) for the Two Eagle River School, to illustrate the importance of alternative heating cost assumptions for project economics. For sensitivity analysis, we assumed a 20% increase in the cost of heating the school due to increases in power and fuel costs. This assumption has a significant impact on project, increasing IRR from 0.79% to 10.29% and reducing payout period from 9 to 8 years.

Financing Terms

Project financing sensitivity cases evaluated debt financing was as low as 5% and as high as 8% and for a period varying from as short as 10 years to as long as 20 years. Leveraging Tribal investment has a significant impact on project economics. A longer financing term and lower interest rate certainly have positive impacts on the project. Using base case assumptions for the Two Eagle River School, again adjusted to reflect a 50% grant subsidy ($250,000), the importance of financing terms are illustrated as follows:

Project Economics Sensitivity to Financing Terms

% Debt	Interest Rate	Term	IRR	Payout Years
65%	5%	10 years	13.22%	11 years
65%	5%	15 years	15.39%	7 years
65%	5%	20 years	17.45%	6 years
65%	8%	10 years	11.04%	18 years
65%	8%	15 years	11.91%	9 years
65%	8%	20 years	12.92%	7 years

Green Credit Contribution

In addition to grants, monetization of green attributes can be applied to reduce capital requirements. NativeEnergy, Inc. has evaluated our project and estimates that the project would avoid release of 223 metric tons of CO2 annually. Based on a twenty year forward stream contract and a minimum purchase price of $5.00 per metric ton NativeEnergy, Inc. can provide $22,280 in funding.

This twenty year contract offer is only available through May 1, 2009 due to NativeEnergy's involvement with the International Carbon Reduction and Offset Alliance (ICROA). In June/July of 2009, a policy will come into effect limiting contract term to a maximum of 10 years. This would of course cut the original twenty year contract amount in half to $11,140.

Using base case assumptions for the Two Eagle River School with a 50% grant subsidy ($250,000) and applying green credits of $22,280 to reduce capital cost from $500,000 to $227,720 reduces the payout period from 9 to 8 and increases IRR from 9.79% to 11.22%.

On-line Factor

Using base case assumptions for the Two Eagle River School, again adjusted to reflect a 50% grant subsidy ($250,000), reducing the on-line factor from 100% to 90% during the heating months increases pay out years from 9 years to 10 years and reduces IRR from 9.79% to 8.31%.

5.4 Summary and Conclusions

Project economics are most sensitive to capital costs and financing terms.

The base case assumptions were made to illustrate project economics without any grant subsidy or financing assistance. To be viable, the project will require some assistance. The team modeled an "expected" case to illustrate how the project might be reasonably expected to perform. "Expected" case assumptions are as follows:

- On-line factor – 95% during heating season
- Plant operation labor force – no additional personnel required.
- Total investment - $500,000
- Fuel Cost - $25/ton
- Green Credits – $11,000
- No taxes or depreciation tax credits
- 35% equity financing
- 65% debt financing (15 years, 7%)
- $250,000 grant or capital cost subsidy
- Alternative energy cost for heating 10% higher
- Discount rate – 10%

The "expected" case has an IRR of 12.32% and a payout period of 8 years. Annual fuel cost savings with these assumptions is over $27,000. If future heating costs are assumed to be 20% higher than 2008 levels, the project IRR increases to 16.23% and payout period is reduced to 6 years.

6. REGULATORY, ENVIRONMENTAL AND CULTURAL ANALYSIS

6.1 Required Permits and Approvals

The U.S. Environmental Protection Agency (EPA) recently revised the national ambient air quality standards (NAAQS) for particulate matter (PM). NAAQS are intended to protect public health and are established for six criteria air pollutants. The revisions affect the NAAQS for fine PM less than or equal to 2.5 microns (PM2.5) in aerodynamic diameter and for particles less than or equal to 10 microns (PM10). The revisions also affect the ambient air monitoring requirements for PM.

According to the Montana Department of Environmental Quality (DEQ) any biomass boiler contributing more than 25 tons of any of the following emissions is required to be permitted:

- Carbon Dioxide (CD)
- Carbon Monoxide (CO)
- Nitrogen Dioxide (NO2)
- Sulfur Dioxide (SO2)
- PM10
- PM2.5
- Ozone (VOC)
- Lead

Typically only commercial scale operations reach these limits. The smaller “Fuels for Schools” types of boiler systems do not reach levels requiring permits. As can be seen from stack testing results of Messersmith systems at schools in Darby and Victor, Montana, the system’s potential to emit pollutants is well below permit trigger levels.

$PM_{2.5}$, NO_x AND CO EMISSIONS FROM THE VICTOR SCHOOL MESSERSMITH HURST STEAM BOILER VICTOR, MONTANA

Test Dates: February 12-13, 2008

Prepared for:
Bitter Root RC & D
1709 North First Street
Hamilton, Montana 59840

Prepared by:
Bison Engineering, Inc.
1400 11th Avenue
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(406) 442-5768
www.bison-eng.com

Report Date:
April 4, 2008

EXECUTIVE SUMMARY

Bison Engineering, Inc. (Bison) was retained by Bitter Root RC&D to perform emissions testing for particulate matter less than 2.5 microns ($PM_{2.5}$), total particulate matter (TPM), nitrogen oxides (NOx) and carbon monoxide (CO) on the Victor School Messersmith Hurst steam-fired hot water boiler located in Victor, Montana. The following table presents the results of the low-fire and high-fire testing.

Table 1: Messersmith Hurst Steam Boiler Stack Emissions

Messersmith Hurst Steam Hot Water Boiler Victor School, Victor, MT Stack Emissions			
Emissions	**Units**	**Low-Fire** **Feb. 12, 2008**	**High-Fire** **Feb. 13, 2008**
$PM_{2.5}$	Concentration	0.0230 gr/dscf	0.0379 gr/dscf
	Mass rate	0.099 lbs/hr	0.247 lbs/hr
	Emission factor	0.097 lbs/MMBtu	0.099 lbs/MMBtu
TPM	Concentration	0.033 gr/dscf	0.073 gr/dscf
	Mass rate	0.142 lbs/hr	0.473 lbs/hr
	Emission factor	0.139 lbs/MMBtu	0.192 lbs/MMBtu
NOx	Concentration	43.2 ppmdv	58.8 ppmdv
	Mass rate	0.16 lbs/hr	0.32 lbs/hr
	Emission factor	0.153 lbs/MMBtu	0.129 lbs/MMBtu
CO	Concentration	205 ppmdv	155 ppmdv
	Mass rate	0.45 lbs/hr	0.51 lbs/hr
	Emission factor	0.44 lbs/MMBtu	0.20 lbs/MMBtu
Heat Input		1.02 MMBtu/hr	2.48 MMBtu/hr
Percent of 2,600,000 Btu/hr		39%	96%

Table Nomenclature

gr/dscf	grains per dry standard cubic feet (@ 68°F and 1 atm.)
lbs/hr	pounds per hour
lbs/MMBtu	pounds per million British thermal units
ppmdv	parts per million dry volume
MMBtu/hr	million British thermal units per hour
%	percent

$PM_{2.5}$, NO_x AND CO EMISSIONS FROM THE DARBY SCHOOL MESSERSMITH HURST STEAM BOILER DARBY, MONTANA

Test Dates: February 13-14, 2008

Prepared for:
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1709 North First Street
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Prepared by:
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Revised Report Date:
April 25, 2008

EXECUTIVE SUMMARY

Bison Engineering, Inc. (Bison) was retained by Bitter Root RC&D to perform emissions testing for particulate matter less than 2.5 microns ($PM_{2.5}$), total particulate matter (TPM), nitrogen oxides (NOx) and carbon monoxide (CO) on the Darby School Messersmith Hurst steam-fired hot water boiler located in Darby, Montana. The following table presents the results of the low-fire and high-fire testing.

Table 1: Messersmith Hurst Steam Boiler Stack Emissions

Messersmith Hurst Steam Hot Water Boiler Darby School, Darby, MT Stack Emissions			
Emissions	**Units**	**Low-Fire** **Feb. 13 2008**	**High-Fire** **Feb. 14 2008**
$PM_{2.5}$	Concentration	0.0503 gr/dscf	0.0279 gr/dscf
	Mass rate	0.229 lbs/hr	0.223 lbs/hr
	Emission factor	0.129 lbs/MMBtu	0.091 lbs/MMBtu
TPM	Concentration	0.082 gr/dscf	0.053 gr/dscf
	Mass rate	0.373 lbs/hr	0.425 lbs/hr
	Emission factor	0.212 lbs/MMBtu	0.172 lbs/MMBtu
NOx	Concentration	51.4 ppmdv	52.6 ppmdv
	Mass rate	0.20 lbs/hr	0.34 lbs/hr
	Emission factor	0.113 lbs/MMBtu	0.139 lbs/MMBtu
CO	Concentration	185 ppmdv	168 ppmdv
	Mass rate	0.39 lbs/hr	0.75 lbs/hr
	Emission factor	0.22 lbs/MMBtu	0.31 lbs/MMBtu
Heat Input		1.77 MMBtu/hr	2.46 MMBtu/hr
Percent of 3,300,000 Btu/hr		53%	75%

Table Nomenclature

gr/dscf	grains per dry standard cubic feet (@ 68°F and 1 atm.)
lbs/hr	pounds per hour
lbs/MMBtu	pounds per million British thermal units
ppmdv	parts per million dry volume
MMBtu/hr	million British thermal units per hour
%	percent

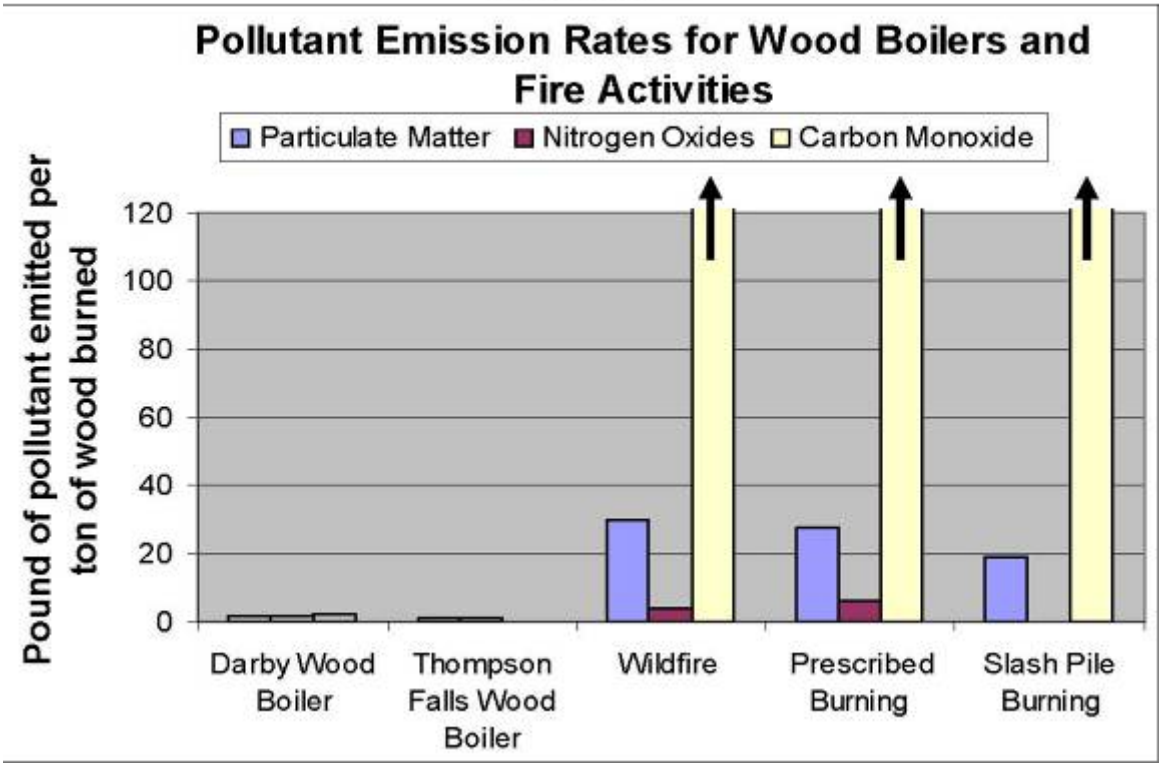
It should be noted that future projects may need to concern themselves with the potential of the location of the project being placed in a non-attainment area which would lower the emission levels triggering permit requirements. In the Flathead County area, Whitefish, Kalispell and Columbia Falls have all been assigned the designation. There is concern that both the Bitterroot Valley and Flathead may become designated non-attainment areas. EPA was conducting air quality testing throughout 2008 and is anticipated to announce new non-attainment designations for PM2.5 in near future.

Although emissions do not require a permit, there is concern about down wash effect on emissions near a building increasing the ground level pollutant concentrations, particularly when a boiler system is located at a school. This concern is addressed in the engineering phase of project development and is usually rectified by choosing the appropriately sized (height) stack.

DEQ does not have the authority to place requirements to stack sizes, but they do offer assistance in determining the appropriate size for a specific project by utilizing a program they designed that considers the location of the stack, the layout of the school property and adjacent building heights. This assistance includes stack modeling with regard to the surrounding topographical features and expected emissions. Good Engineering Practices (GEP) utilizes a standard of 2.5 times taller than the adjacent building height. The DEQ program produces a more accurate result that often provides for a lesser height.

As illustrated on the chart below, emissions from a Messersmith system (Darby) and a Chiptec system (Thompson Falls) are much lower than emissions from open burning (forest fires, prescribed burning, or slash pile burning).

CHART 1



6.2 Culture Committee Feedback

The Salish and Pend Oreille Culture Committee is very interested in the project and would like to be advised of the final report submission to Council. The Committee asked for a CD of the pictures the team took at Darby and Glacier, which has been provided, and stated "that they may be interested in a site visit to Darby" pending the final report. There were no major concerns or issues brought to the table.

The Kootenai Culture Committee was supportive of the project. One elder expressed concern over increased smoke being generated from the burning of biomass. The elder was happy to hear that the technology utilized will be far more efficient than current wood burning stoves and the project will reduce overall smoke exhausted with the reduction and potential elimination of slash pile burning in the forests. The Committee expressed that they "would like to see the available biomass material used locally and not for the benefit of off-Reservation businesses."

6.3 Solid Waste Management Plan

The amount of solid waste (ash) generated from the biomass heating system is highly dependent upon fuel quality. The Messersmith system in Boulder County, Colorado generates about a wheelbarrow per day of ash. The Boulder County system is somewhat larger than the system proposed for Two Eagle River School. It uses about 600 tons per year of fuel; while Two Eagle anticipates using about 400 tons per year. The Boulder County system is fueled with chips from whole tree chipping; a fuel similar to what would be available to Two Eagle River School from chipping slash. The Darby and Victor, Montana schools with Messersmith systems burn wood chips from wood product manufacturing waste; a fuel similar to what would be available to Two Eagle River School from area wood product manufacturers. Those schools generate much less ash than Boulder County, Colorado (about one wheelbarrow per week).

The team anticipates that there will be about one wheel barrow per week of ash generated at the proposed Two Eagle River School operation. The material is not hazardous. Darby school reportedly uses the ash to fertilize their football field. In any event, the small amount of ash generated does not represent a disposal problem.

6.4 Traffic Impacts

The number of fuel deliveries to the school is dependent upon the size of the delivery. If 30 ton capacity live floor trailers are used to transport fuel, 12 to 15 deliveries will be required for an entire heating season. If smaller trucks are used, the number of deliveries could be 5 to 10 times more, depending upon the size of the truck. Even if deliveries are made using small trucks, only about 150 deliveries (about 1 per day) would be required. No significant impact on traffic is anticipated.

7. LONG TERM SUSTAINABILITY AND REPLICABILITY

7.1 Anticipated Benefits and Assessment Plan

The potential benefits to the Tribes and its members include meaningful employment chipping and transporting slash generated from forestry operations, reduced air pollution by avoiding slash pile burning, and operating cost savings at Two Eagle River School and other future applications. Bio fuel heating is a good fit environmentally, socially, economically, and culturally, as biomass is a renewable energy source.

Potential barriers to the Tribes and its members that could impede the project are economics and project financing. Montana's "Fuels for Schools" program has provided grants to apply toward reducing the capital cost required for numerous school applications in our region so that these projects would be economically viable. This program has been unfunded in recent years, however, is currently slated to receive federal funding that could apply toward a project implementation at Two Eagle River School.

7.2 Training, Operation and Maintenance Plans

According to system operators at Darby and Victor schools, the Messersmith system is not difficult to operate. Existing personnel are able to operate and maintain the system after startup assistance and the operation and maintenance training provided by the vendor. The operator at Darby reported that maintenance expense and staffing requirements actually went down when they replaced their boilers with Messersmith's biomass-fired system.

7.3 Other Applications

Planned construction and operations with potential biomass heating application for the next six years include:

- St. Ignatius Tribal Health Center expansion
- Polson Tribal Health building
- Natural Resource Department / Forestry building
- Forestry Greenhouse application
- Cluster building complexes
- Kiln for Flathead Sticker and Lath
- SKC expansion

Planned buildings have potential for an additional demand of 1,200 to 3,400 tons per year of biomass material. Virtually all of the potential additional biomass demand for heating buildings is located along Highway 93, from Polson to St. Ignatius.

8. LESSONS LEARNED

Biomass Fuel Supply

- There are ample supplies of suitable biomass fuel for heating Tribal buildings from existing wood products manufacturers in the region and from Tribal Forestry operations.
- The type of fuel is important. Hog fuel, hog fuel pellets, and species such as spruce are not good candidates for small biomass heating applications. The wrong fuel will also result in additional maintenance and other fuel associated problems.
- The shape and size of fuel is important. Stringy or oversized pieces of fuel will result in fuel handling problems. The shape and size of fuel should be held consistent once the fuel handling systems is implemented.

Applicable Biomass Technology

For building heating requirements and fuel quality and cost on the Flathead Reservation, Messersmith Manufacturing, Inc. provides a proven technology and has demonstrated the technology successfully in the region. Operators of Messersmith biomass heating systems in Montana express a high level of satisfaction with Messersmith technology and vendor support.

Application Opportunities

The Confederated Salish and Kootenai Tribes have one existing building, Two Eagle River School, which is ideal for a retrofit conversion to biomass heating. Suitable land for equipment and fuel storage, access for fuel delivery, proximity to fuel supply, and existing building and water heating systems that are easily retrofitted to accommodate biomass are favorable attributes of the site. In addition, the Tribes are planning additional structures that can be designed to accommodate biomass heating systems.

Project Economics

Capital cost and financing terms are the two most important factors effecting project economics.

The Two Eagle River School project, like most “fuels for schools” projects, requires some capital cost subsidy to be economically justified.

Funds required to install biomass heating equipment could be partially offset by monetizing “green attributes” of the project.