Ontonagon Economic Development Corporation

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Final Report

Pellet Mill Viability Analysis

Competence. Service. Solutions.

Ontonagon County Economic Development Corporation
725 Greenland Road
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Pellet Mill Viability Analysis
Final Report

Contents

1 Introduction
2 Raw Material Supply
3 Wood Pellet Markets
4 Pellet Production Facility Description
5 Capital Cost
6 Manufacturing Costs
7 Financial And Viability Analysis

Executive Summary

Introduction	The Ontonagon EDC engaged Pöyry (Appleton) LLC to complete a Preliminary Engineering Study and Cost Estimate for a plant to produce wood fuel pellets. A facility with a capacity of 70,000 tons of pellets per year was selected as the Base Case.
Raw Material	Raw material in the form of wood processing residues is available from a few larger operations and many smaller facilities in the Western Upper Peninsula. Plant capacity and viability will be determined by security of supply and delivered cost of wood residues. A detailed fibre sourcing plan is required to confirm project viability.
Pellet Markets	Since 2000 domestic demand for wood fuel pellets has more than doubled to about 1.5 million tons per year. However, size of the regional market is more important than national trends for pellet consumption as cost of delivering pellets to the end user is an important factor in determining profitability. Confirmation and definition of the regional market within approximately 300 miles of the plant site is a priority to move forward.
Pellet Manufacturing	The technology for production of wood pellets is well established. The equipment is similar to that used for particle board and OSB and is available from a number of creditable suppliers. The main process steps are drying wood residues to 8% moisture and extruding the pellets with equipment similar to that used for production of agricultural products.
Capital Investment	The cost of constructing a 70,000 ton per year facility is estimated at approximately $16 million for required structures and buildings, equipment purchase and installation, and associated utilities as well as engineering and project management. It is expected that additional funding of approximately $2.5 million will be required to establish the business and for initial working capital, bringing total investment to about $18.5 million.

Revenues and Costs

Sales revenue and costs for production of 70,000 tons per year are estimated approximately as follows:

Revenue	**$/ton**
Delivered Price	200
less Bagging	20
less Delivery	20
Mill Net Price	**160**
Manufacturing Cost	
Raw Material	37
Energy	34
Other Variable	7
Fixed Costs	27
Total Manufacturing	**105**
EBITDA	**55**

EBITDA

Earnings before Interest, Taxes, Depreciation, and Amortization at $55 per ton for 70,000 tons is estimated at approximately $3.9 million per year. On an $18.5 million investment, the Total Enterprise Value multiple to EBITDA is approximately 4.7, a reasonably attractive value for an industrial energy project.

Sensitivity

EBITDA is most sensitive to fibre cost ($ per green ton) and mill net revenue ($ per ton at the mill fence). The table below shows EBITDA ($ per ton of pellets) related to these two key variables.

EBITDA ($/ton pellets)

Fibre Cost ($/green ton)	Mill Net Revenue ($/ton)				
	120	**140**	**160**	**180**	**200**
10	34	54	74	94	114
15	25	45	65	85	105
21	15	35	55	75	95
25	8	28	48	68	88
30		19	39	59	79
35		10	30	50	70
40		1	21	41	61
45			12	32	52
50			3	23	43

Base Case Values are shaded and negative values (associated with high fibre costs and low mill net revenues) are omitted.

Viability

Viability of the plant depends on mill net revenues very near, or above, the Base Case value of $160 per ton of bulk pellets and weighted average fibre costs that do not exceed $30 per green ton.

1 INTRODUCTION

The Ontonagon County Economic Development Corporation (EDC) engaged Pöyry (Appleton) LLC (Pöyry) on 12 December 2006 to complete a Preliminary Engineering Study and Cost Estimate for a plant to produce wood fuel pellets. A facility with a capacity of 70,000 tons of pellets per year was selected as the Base Case.

This report meets the essential terms of reference in the Request for Proposals issued by the EDC, dated 20 October 2006.

Preface

This report is provided to the Ontonagon County Economic Development Corporation for its own use. No responsibility is accepted by Pöyry for any other use.

The report contains analysis and opinions of Pöyry with respect to wood fuel pellet manufacturing technology, markets, and costs. Nothing in this report should be relied upon as a promise by Pöyry with respect to future project investments, revenues, and operating costs. Actual results may be different from the opinions contained in this report, as anticipated events may not occur as expected and the variations may be significant. Pöyry has no responsibility to update this report for events and circumstances occurring subsequent to the date of this report.

2 RAW MATERIAL SUPPLY

Security of supply and delivered cost of wood residues are key factors that will determine the configuration and capacity for a wood pellet plant in Ontonagon County.

The Forest Products Industry Directory web site of the Michigan Department of Natural Resources (DNR) lists some 295 businesses located in the Western Upper Peninsula (WUP) and 288 in the Eastern Upper Peninsula (EUP). Of the listed businesses 65 in the WUP and 82 in the EUP are classified as sawmills and planning mills or producers of millwork, veneer, plywood, and structural panels – operations that typically generate by-product wood residues that are suitable for manufacturing wood pellets.

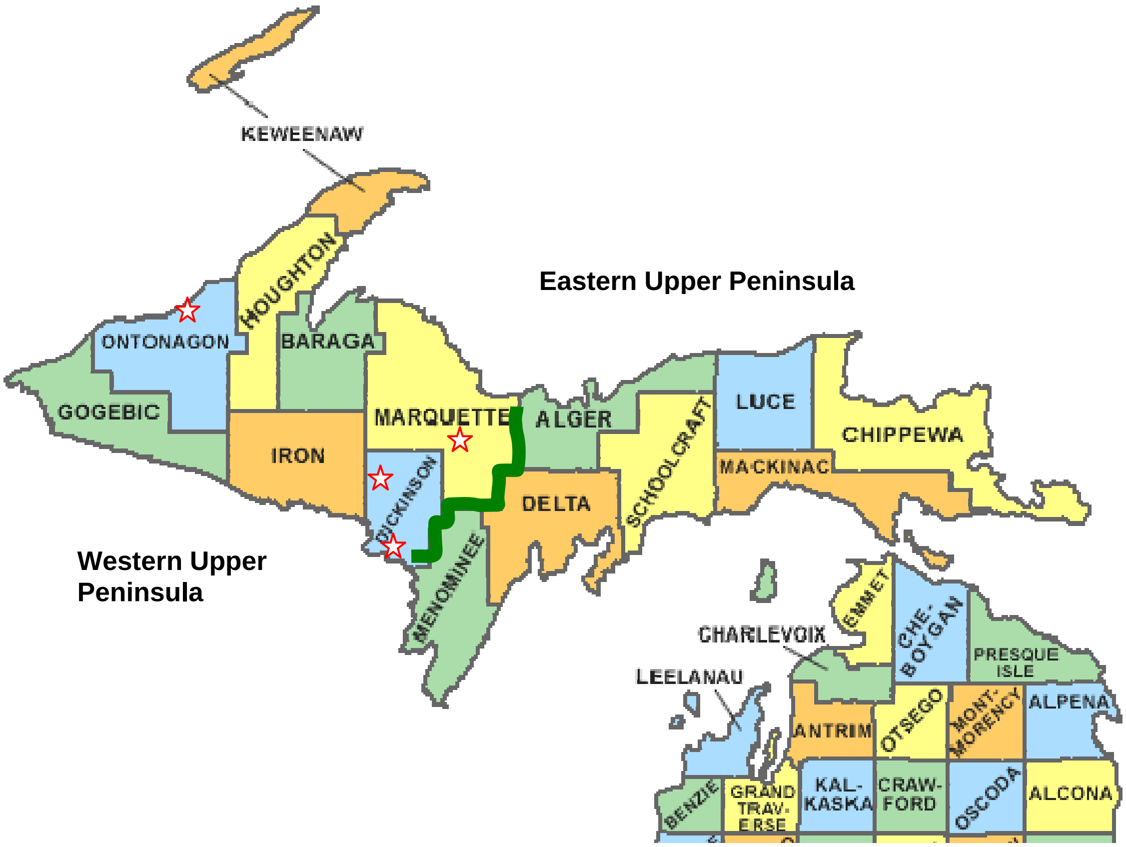
Primary processing residues include bark, sawdust, shavings, and chips. These residues are typically used as raw material for secondary products or as fuel. Bark is generally limited for use as fuel; sawdust and shavings are used to make composite board products or as fuel; and chips are used for pulp production.

Pulp and paper mills and particleboard plants capture the fibre value of wood residues, which is almost always higher than the fuel value. The pulp and paper mills in the region also chip pulpwood logs to supplement the wood residues (chips), which are not sufficient to meet the regional demand for pulp and paper fibre.

The Oriented Strand Board (OSB) mills at Sagola and several locations in Michigan, Wisconsin, and Minnesota also use pulpwood as raw material. Residues cannot be used for OSB manufacture. Bark and other residues derived from OSB manufacture are almost always used at the OSB plant as fuel for drying the wafers and for forming press heating. A typical OSB plant has either a small demand for, or small surplus of, wood waste fuel.

Pöyry consulted several publicly available references as well as two reports provided by the Ontonagon County EDC to assess supply and demand for wood residues in the Upper Peninsula.

- Michigan's Forests 1993: An Analysis, USDA, Resource Bulletin NC-179, February 1997
- Pulpwood Production in the North-Central Region, 2004, USDA, Resource Bulletin-265, 2006
- Profile 2005: Softwood Sawmills in the United States and Canada, Research Paper FPL-RP-630, August 2005
- Draft 2006 State Forest Management Plan, Michigan DNR, August 2006
- White Pine Electric Power Biomass Feasibility Study, Weston Solutions, March 2006
- Wood Waste in Michigan's Upper Peninsula, Community Consulting Services, May 2004



There are four major forest industry operations in the WUP; locations are shown by the red stars on the map.

Owner	Location	County	Facility	Approximate annual wood consumption
Smurfit Consolidated	Ontonagon	Ontonagon	285,000 tons per year virgin and recycled corrugating medium	15 million cu ft hardwood – 85% pulplogs, 15% residual chips
Louisiana Pacific	Sagola	Dickinson	370 million sq ft per year OSB	18 million cu ft mostly hardwood pulplogs
International Paper	Quinnesec	Dickinson	400,000 tons per year bleached hardwood kraft pulp for the market and for coated papers	40 million cu ft mostly hardwood pulplogs
Potlatch Corporation	Gwinn	Marquette	170 million board ft per year lumber/studs	24 million cu ft softwood sawlogs

Primary fibre consumption for these four major facilities, equivalent to about 90 million cu ft per year of round logs, is essentially equal to the total harvest for all species and timber grades in the WUP.

In addition to these four major operations there are some six substantial forest industry operations each with sales in excess of $10 million per year. Total wood consumption for these companies is believed to be in the order 10-15 million cu ft or about 15% the WUP annual fibre harvest. And, some 20 smaller companies in the WUP, most with sales of less than $1 million per year, are also reported to engage in primary processing of mostly hardwood.

Owner	Location	County	Facility
Aspen Lumber	Sagola	Dickinson	Hardwood lumber products
Northern Hardwoods	South Range	Houghton	Hardwood lumber
Pine River Lumber	Amasa	Iron	Hardwood lumber
Snow Ridge Lumber	Hurley	Iron	Hardwood lumber
Bessemer Plywood	Bessemer	Gogebic	Softwood and aspen veneer and plywood
Bell Forest Products	Ishpeming	Marquette	Specialty lumber products

The 2003 Wood Residue report completed by Community Consulting Services attempted to categorize wood residue generation and use for the 15 counties in the Upper Peninsula. Using the Michigan DNR database, some 200 companies that generated or used wood residues were identified and questionnaires were mailed to 182 firms, of which 19.3% responded. Telephone follow-up was used to gather additional information. This survey identified some 660,000 tons of wood residue including 500,000 tons originating in the WUP.

About 50% of the residues categorized by the Wood Residue report are identified as Clean Coarse Residue (chips). These residual chips are almost certainly directed to the Smurfit Consolidated corrugating medium mill at Ontonagon and the International Paper coated paper and market pulp mill at Quinnesec in Dickenson County and possibly to the NewPage paper mill at Escanaba in the EUP.

The response to the questionnaire accounted for less than one-half of potential wood residue producers. However, comparison of the residue volumes with the WUP wood harvest suggests that the survey accounts for more than one-half of the actual volume generated and possibly significantly more if residue generated at the larger facilities is used internally and was not reported for the survey.

To meet current fibre demand in the WUP a substantial net importation of fibre from the EUP and the neighbouring states of Wisconsin and Minnesota is required. Analysis of the supply and demand for pulplogs, sawlogs, and residues limited to the WUP region provides only a partial indication of the regional balance of supply and demand.

Anecdotal comments included in the Wood Residue report is possibly of more value than the reported data; particularly relevant comments include:

- Few companies expressed concern about disposal of residue and these were generally smaller producers with small quantities of waste.
- 90% of fines (sawdust) and 80% of bark residue is now used as fuel.
- 29 companies provided information on the distance their residues were hauled:

50%	less than 50 miles
20%	50 to 100 miles
25%	100 to 200 miles
5%	over 200 miles

This suggests an average haul distance in the order of 80 miles and this distance has been assumed for supply of primary manufacturing residues to the pellet mill, except for that residue obtained from Smurfit Consolidated.

For this study, Pöyry has assumed that residue from the Smurfit Consolidated paper mill, softwood and hardwood sawmills, plywood plants, and pulpwood chipping operations would provide the raw material for pellet production. Further, it was assumed that bark would be used along with sawdust and shavings. Only clean residues such as sawdust and shavings with a very-low ash content can be used as raw material for premium pellets intended for residential use.

Given the characteristics of the available raw material supply it is possible that a majority of production would need to be sold in bulk as industrial or commercial fuel.

In Europe, particularly in Finland, technology is being developed and used to harvest branches, tops, and other forest residue for fuel. While this approach could possibly be used in the Upper Peninsula, substantial analysis and field trials would be required to confirm viability for North America. For this study it was assumed that wood fibre supply would be limited to processing residues and would not include material suitable for higher valued uses such as pulp and particle board.

It is assumed that Chip Fines would be sourced from the Smurfit Consolidated mill at Ontonagon. Other material identified in information provided to Pöyry by the EDC as being available from the Smurfit Consolidated mill is not suitable for fuel pellet production. Drying the 21% solids sludge is not economic. The high ash-content fly ash is not suitable for pellets.

The following fibre supply scenario has been assumed for Base Case production of 70,000 tonnes of pellets per year.

Ontonagon Pellet Mill Fibre Supply		Chip Fines	Sawmill Residue	Total for Pellets
As received fibre	green tons/a	13,000	112,000	125,000
Solids		55%	55%	55%
Maximum Ash Content		2%	2%	2%
HHV	BTU/green lb	4,700	4,700	4,700
Cost FOB Supplier	$/green ton	5.0	10.0	9.5
Transportation to Site	$/green ton	4.0	12.0	11.2
Delivered Cost	$/green ton	9.0	22.0	20.6
Delivered Cost	$/MMBTU	1.0	2.3	2.2

Agricultural Raw Material Options

Pöyry was also requested to consider agricultural sources as raw material for fuel pellet production.

Census data for 2002 shows some 43,000 acres planted with hay and grass crops in the eight counties that comprise the WUP. Some 11,000 acres or 25% of this area is in Ontonagon County. Wheat planting is recorded at less than 400 acres, almost all in Iron County. This area of grain would only yield about 600 tons of straw. It is assumed that utilization of grain straw will not be relevant and that potential agricultural raw materials for pellet manufacture would originate from new energy crops planted on marginal land that is not currently cultivated or that is not providing a good return from current crops.

The State of Michigan through State agricultural agencies and Michigan State University has completed considerable research and development to foster production of bioenergy crops, in particular switchgrass. A pellet mill in Ontonagon County could use switchgrass as a raw material as well as for fuel for the pellet dryer. Given a market for switchgrass substantial regional production could be established. With a yield of 5 tons per acre, 20,000 tons could be harvested from 4,000 acres. This volume of switchgrass would be sufficient to produce about 15,000 tons of pellets.

There are both positive and negative attributes associated with using switchgrass compared to wood residues.

Switchgrass can be planted on marginal land and full-yield cropping is achievable in three years. Switchgrass is a perennial that does not require replanting for 15 years or more and two crops can be harvested per season. The moisture content of switchgrass is 15-20% compared to 50% for wood residues. With switchgrass drying energy would be reduced from over 2 million BTU to about 0.8 million BTU per ton of pellets.

Annual crops like switchgrass must be harvested at specific times of the year and large inventories accumulated to provide year round supply for processing facilities.

Furthermore, the storage density is very low and the fire hazard with the dry material is high. Storage could be located at the growing site or at the processing facility.

The properties of pellets made from switchgrass would generally be less desirable than those produced from wood. The pellet density would be 5-10% less and the heating value would also be 5-10% lower. With respect to retail sales the most important difference would be ash content of 4.5-6% compared to less than 1% for premium wood pellets. For industrial use the absolute ash content would probably not be a serious concern but the characteristics of the ash could lead to boiler operational difficulties. Switchgrass ash would be high in sodium, potassium, and silica and the ash fusion temperature would be significantly lower than for wood pellets.

While there are some technical concerns with respect to using switchgrass for pellet production, viability is more likely to be driven by cost. Feasibility of wood pellet manufacturing is driven primarily by the delivered cost of the raw material. Wood residue is a by-product of other processing operations and its value is derived from market demand not the proportionate cost of producing the material. The cost of switchgrass delivered to a pellet mill would need to bear the full cost of land, planting, maintenance of the land, harvesting, financing and maintenance costs of annual inventories, and transportation to the pellet mill.

The cost of producing switchgrass in the WUP is unknown. However, a study published by Iowa State University (University Extension, Costs of Producing Switchgrass for Biomass in Southern Iowa, April 2001) indicates costs in excess of $50 per ton for baled switchgrass loaded on a truck at the growing site. The cost is highly sensitive with respect to the yield, and to achieve a $50 per tonne cost, productivity of 5-6 tons per acre is required. Transportation and storage costs as well as correction for moisture content and heating value must be added to the Iowa costs to obtain a comparable cost to wood residue. Assuming $50 per ton of switchgrass at the field loaded on a truck, $10 per tonne for transportation and storage, 15% moisture, and 95% of wood HHV, the equivalent competitive cost for wood residue would be approximately $75 per bone dry ton.

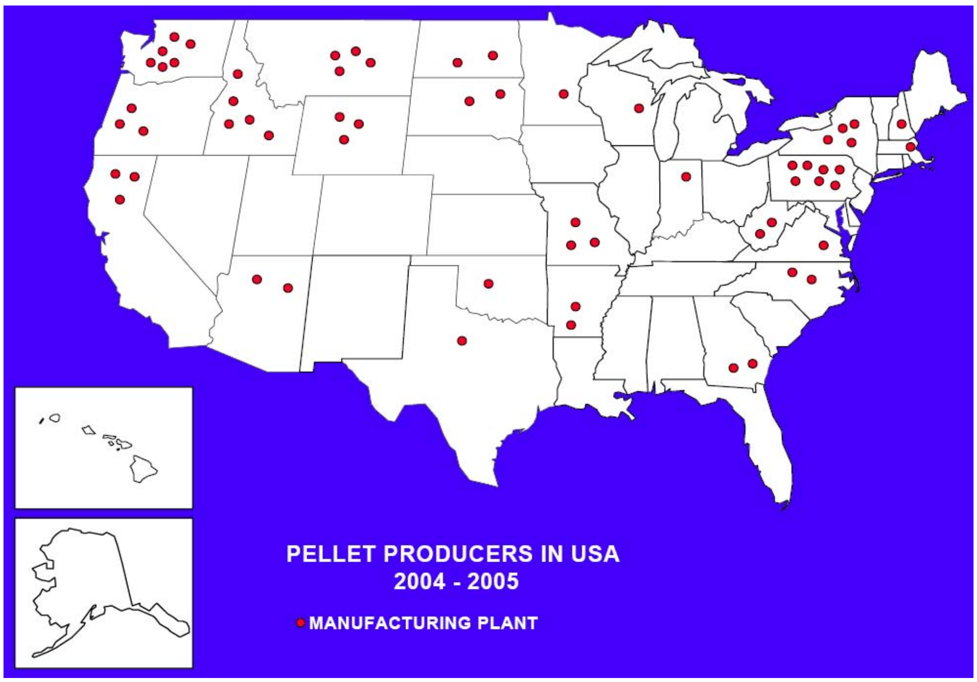
The marginal cost of wood residues for a pellet mill in Ontonagon County has been estimated at $22 per green ton or approximately $40 per bone dry ton delivered to the pellet mill. Given current information, baled switchgrass would not be competitive with wood residues.

The only significant facility change required to utilize baled straw or switchgrass would be addition of a bale breaker and shredder or a tub grinder along with associated conveyors.

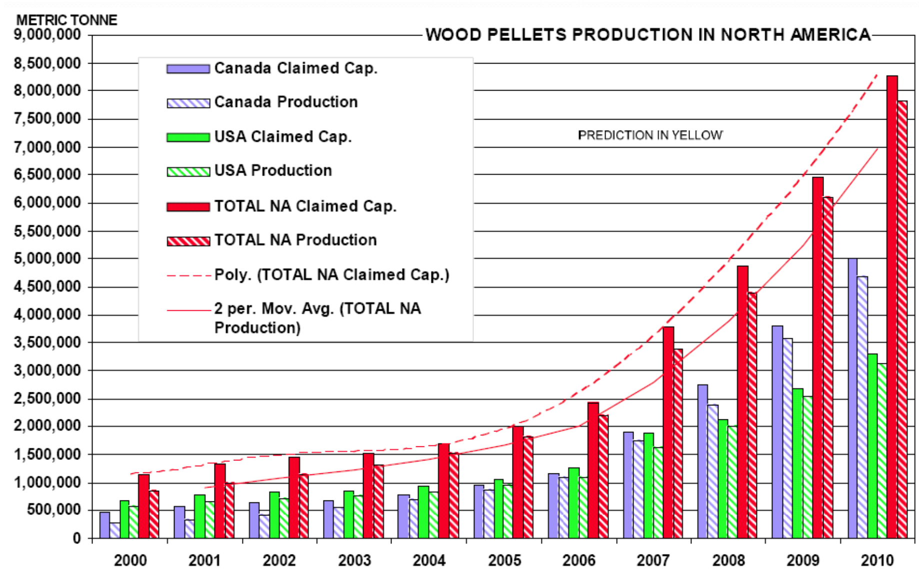
If a supply can be established, a pellet mill in Ontonagon County could start by using switchgrass as fuel and as a fraction of the feedstock in conjunction with wood residues. Increased use could be developed based on the relative availability and cost of switchgrass and wood residues.

3 WOOD PELLET MARKETS

There are currently some 60 wood fuel pellet plants in the US with a total capacity of 1.5-2.0 million tons per year. The higher value is forecast for 2007, a 50% increase over 2006. There is some uncertainty as to how many of the planned plants will be completed and put into operation by the end of this year.

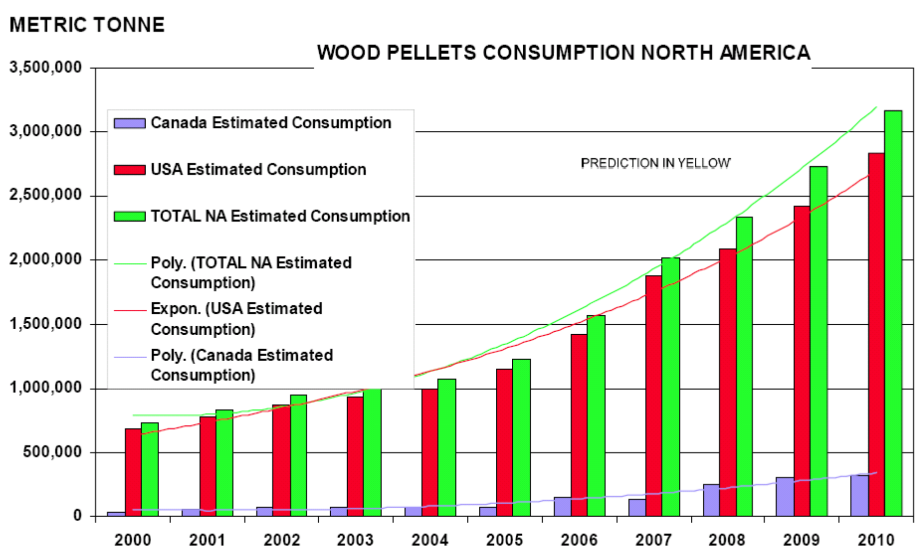


As indicated below US Capacity could grow at an annual rate of over 25% to 3.5 million tons by 2010.



Currently most of the US pellet plants are relatively small – many have capacities of less than 15,000 tons per year. The rapid growth in capacity will be sustained by the introduction of larger plants such as a 100,000 ton per year plant at Schuyler, New York. In October 2006, New England Wood Pellet LLP announced that construction had commenced for completion in May 2007. The plant will be located in an Empire Zone, which provides certain tax and job creation incentives.

US demand for pellets is forecast to grow in step with capacity and production.



Source: Domestic and International Markets for Wood Pellets, Wood Pellet Association of Canada, October 2006 (also the source for the preceding map and graph)

With continued pressure for use of renewable energy, there is little doubt that there will be growing demand for wood fuel pellets. The more important question is the strength and characteristics of the nearby markets in Michigan, Wisconsin, and Minnesota. Detailed regional market analysis is required and recommended before a commitment is finalized to construct a plant.

As an example, New England Pellet expects to increase combined production and distribution from 75,000 tons to 300,000 tons in the next several years (USDA Forest Service News Release, October 30, 2006). The Company also advises that it bags over 80,000 tons per year of pellets imported in bulk from British Columbia. This material is then distributed throughout the northeast.

Retail demand for pellets is, of course, seasonal. Thus, it is anticipated that industrial, and possibly export, markets would be developed in conjunction with retail sales. And, industrial markets would be required if a major fraction of the raw material is bark, not suitable for premium pellets for residential sales.

Over 6 million tons of wood fuel pellets are now consumed in Europe. Imports account for a substantial fraction of the supply, including some 600,000 tons from Canada, mostly from British Columbia. Pellets could be shipped to Europe from Ontonagon during the months when the St Lawrence Seaway is open and domestic seasonal demand would be reduced. The viability of this approach is contingent on cost effective shipping arrangements, preferably through the port at Ontonagon directly to Europe via ocean going vessels.

The five leading countries in Western Europe consume 5.5 million tonnes alone: Sweden (1.5), the Netherlands (1.4), UK (1.0), Denmark (0.8), and Belgium (0.7).

The European market is largely driven by tax and green house gas incentives and is expected to grow at 5-10% annually. European production is already committed for 2007. There is no doubt that a market could be secured in Europe. But export sales are contingent on definition of cost effective shipping logistics. Limited initial investigation indicates exports might be viable as long as European prices remain strong, if shipping can be established at the low-end of the expected cost range.

Transaction price and shipping cost expectations are discussed in Section 7, Financial Analysis.

4 PELLET PRODUCTION FACILITY DESCRIPTION

The mill facility will be designed to produce 70,000 tons of pellets per year, at the nominal operating rate of 10 tons of pellets per hour. The system will be capable of producing industrial fuel pellets with an ash content of up to 3% from lower cost raw materials such as bark. The plant will also be able to produce premium pellets, with an ash content of less than 0.5-1.0%, from select materials for retail markets.

The overall design and layout of the proposed facility is illustrated by a flow diagram and layout presented in Appendix 2.

It is assumed that wood residues will be delivered by self-unloading trucks (tipping or walking floor configurations). A small- to mid-size wheel loader with a 5-6 cu yd chip bucket will be used to transfer the raw material to a covered storage area. Covered storage with a capacity of approximately 350 tons, which represents about 24 hours production, will be provided.

A single wood residue feed bin will be provided to feed the dryer. Multiple raw materials will be blended into the dryer feed bin using the wheel loader. A coarse screen will be provided to remove oversize material but it is assumed that only well graded material will purchased and that a coarse hammer mill will not be required. Provision could be incorporated in the layout for future installation of a hammer mill.

The dryer will be direct fired with natural gas. Use of a wood residue combustor was also considered but deleted from the scope to reduce capital investment. The incremental cost of a combustor designed to use wood residue at 45-50% moisture was estimated to be in excess of $2 million. Fuel cost savings that could be realized with a wood residue combustor are discussed in Section 6, Operating Costs.

The dryer will be capable of handling a range of graded wood residue with an average moisture content of up to 60%. Product from the dryer will be directly conveyed to the pelletizing plant.

The drying operation will liberate some volatile organic compounds (VOCs) from the wood. As the specific emission requirements for the site have not been defined, an allowance for a regenerative thermal oxidizer (RTO) or other advanced control device has not been included. It is assumed that a location will be selected that will avoid the requirement for VOC emission control. Provision is included for high-efficiency cyclones or a bag house.

The pelletizing operation will be housed in a building that contains a surge bin, the fine hammer mill, pellet mills, and a pellet cooling and screening system. Dust control will be accomplished in this area with two dust control system, isolated from each other to minimize fire risk. In addition, spark detection equipment and controls will be installed in accordance with standards for good industrial practice.

Cooled pellets will be transferred to a surge bin for loading to trucks for bulk sales or to a bagging line to fill 40-lb bags for retail sales. The bags will be stacked on pallets for truck shipment.

The fuel storage area and the dryer combustor, pellet mill, and finished pellet storage buildings will be equipped with fire sprinklers and appropriate dust control systems.

The mill processes will be controlled using a centralized digital control system. Control stations will also be located near equipment to facilitate local operation and maintenance. Overall operational status and production will be monitored with a centralized digital control system, which will be integrated with a business data system to track raw material and wood fuel deliveries and usage, natural gas and power consumption, and pellet shipments.

It is assumed that existing building on the selected site will be suitable for administration facilities, a small maintenance shop, storage of maintenance materials and parts, and for the bagging line. New buildings will be constructed for the pelletizing line and for raw material storage. It is assumed that the selected site will also be suitable for parking for employees and visitors and yard space for staging trucks making raw material deliveries or waiting for load product for shipment.

5 CAPITAL COST

The project cost estimate is summarized below.

Project Cost Summary		Fraction of	
	$ 000's	Direct Cost	Total Cost
Direct Costs:			
Process Equipment	5,100	38%	32%
Equipment Installation	1,400	10%	9%
Buildings & Structures	2,500	19%	16%
Electrical	2,700	20%	17%
Process Control	900	7%	6%
Site Preparation	370	3%	2%
Utilities	350	3%	2%
Other	180	1%	1%
Total Direct Costs	13,500	100%	84%
Indirect Costs	900	7%	6%
Contingency	1,600		10%
Total Project Cost	16,000		100%

The accuracy of the estimate is appropriate for use in planning and financial analysis. The estimate was prepared on the following basis.

Process equipment costs were based on vendor budget proposals and Pöyry cost databases. Historic costs were escalated to first quarter of 2007 when required. Allowance has been made for required minor and miscellaneous equipment. It was assumed that equipment and system design would be purchased in major packages from selected vendors using competitive bids.

Equipment installation costs were estimated based on the complexity of the installation and the value of the equipment.

Buildings and structures were estimated based on the preliminary building sizes, as shown on the preliminary facility plan, and on unit costs for similar structures. Costs for fire suppression and sprinkler systems are included in building costs along with provision for employee amenities (restrooms, showers, etc.). As noted, it was assumed that the site chosen for the project will have an existing building or buildings which will be suitable for installation of the bagging line and finished product storage and will also provide for administrative offices, maintenance, and required employee amenities.

Electrical costs, including an allowance for a utility substation, were estimated based on costs typical for similar industrial projects. Process control costs were estimated based on appropriate digital control systems. An allowance is also included for business system hardware and software.

An allowance for site development assumes that most existing site infrastructure will be adequate for the pellet plant. The allowance does not provide for security fencing and lighting or utilities on the site. Allowance has been included for paving the material receiving areas and the new process areas. There is no provision for development costs that could apply to bring services to the property boundary.

There is no provision for piling or other enhanced equipment and building foundations in the estimate. It is assumed that a site would not be selected without adequate geotechnical analysis for foundation design.

Indirect costs for engineering and construction supervision have been estimated based on maximum use of vendor engineering. A contingency of 10% has been included to cover the normal project execution contingencies only. The contingency will not cover scope changes, changes in project capabilities, unanticipated environmental compliance costs or escalation beyond 2007.

The Project Cost does not include:

- Any pre-project expenses, including this study
- Financing costs associated with equity or debt
- The cost of analysis and negotiation to obtain an air emission permit
- Owner's project management costs
- Start-up costs including establishing a corporate organization, employment and training of staff, and pre-operation costs
- Working capital
- Taxes or fees or other government related costs

Allowances for these additional investment costs are incorporated in the financial analysis summarized in Section 7.

The capital cost summarized in this section is a relatively aggressive estimate. Key assumptions for this estimate include:

- Use of a gas burner rather than a high moisture wood residue combustor for the dryer
- Assumptions that the selected site will require minimal upgrading and that existing buildings will be suitable for office, maintenance, and storage purposes and for pellet bagging and warehouse operations.
- No requirement for advanced air emission control.

- Lease, rather than purchase, of mobile equipment and pellet bagging and associated equipment.

6 MANUFACTURING COSTS

Estimated manufacturing costs for pellets are summarized below.

Manufacturing Cost	Unit	Units Used	Cost $/Unit	Cost $/ton pellets	Cost $000/year	
Fibre - product	green ton	1.78	20.60	37		
Fibre - drying fuel	green ton	0.00	22.00	0		
Fibre - total	**green ton**	**1.78**	**20.60**	**37**	**2,561**	**35%**
Power	kWh	160	0.087	14		13%
Natural Gas Fuel	MMBTU	2.1	9.50	20		19%
Operating Materials				7		6%
Total Variable Costs				**78**	**5,363**	**74%**
Maintenance Materials and Services				7	500	7%
Labour	FTEs	22	50,000	16	1,100	15%
Overhead				4	300	4%
Total Fixed Costs				**27**	**1,900**	**26%**
Total Manufacturing Cost				**105**	**7,263**	**100%**

The manufacturing cost estimate is based on the following assumptions:

Fibre	price as set out in the last paragraph of Section 2, unit consumptions as estimated in the design criteria included in Appendix 1
Power	based on average purchased power cost of $87 per MWh, the approximate cost per the Upper Peninsula Power Company tariff for large industrial users (WP-1T), assumed 160 kWh per ton of pellets
Natural Gas	based on a cost of $9.50 per million BTU, the approximate current cost per Semco Energy Gas Company tariff for general service (GS-3), assumed that the dryer would be direct gas fired consuming 2.1 million BTU per ton of pellets.
Operating Materials	assumed at $2 per ton of pellets or $140,000 per year for miscellaneous operating materials and services plus $4 per ton for pellet mill dies and rollers and $0.75 per ton for mobile equipment lease payments and operating costs.
Maintenance	assumed at approximately 4% of the total major equipment cost for purchased materials and services. It is assumed that a minimal maintenance staff would be employed by the pellet company

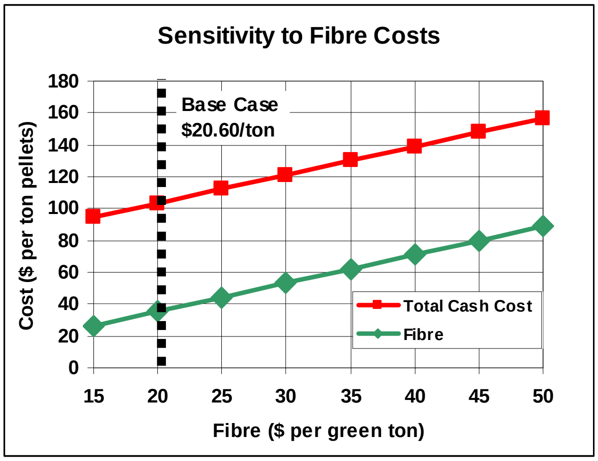
Labour	assumed 22 full time equivalent employees: facility manager, engineering and maintenance manager/lead hand, business assistant, 16 operating technicians (4 crews of 4 technicians), 3 maintenance technicians; average annual employment cost $50,000. The labour cost does not include provision for operation of the bagging line, which will be dependent directly on the configuration of the bagging equipment and the volume of product shipped in 40-lb bags. The mill revenue estimates include an estimated cost of bagging materials, supplies and labour as well as cost of transportation to the purchaser.
Overhead	allowance $300,000 per year

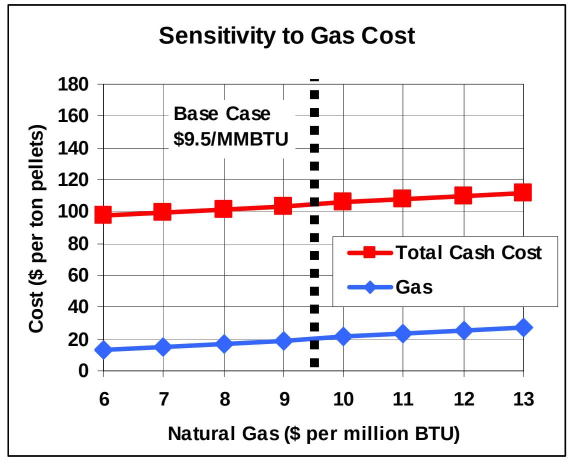
This cost structure is based on bulk shipments by truck. For the retail market pellets are typically bagged in 40-lb poly or sack kraft bags. Bagging could be completed at the pellet plant in a secondary operation or the production intended for the retail market could be shipped in bulk to others for bagging and distribution.

Equipment for bagging pellets for retail sales would cost up to $400-500,000, depending on the bag configuration and the level of automation for filling and stacking the bags on pallets. The total cost of bagging, assuming fifty 40-lb bags per tonne, would be about $20 per tonne, including the cost of bags, pallets for shipping, and direct labour, as well as leasing cost for the bag filling, weighing, and stacking equipment.

As noted, use of a gas burner to supply drying energy has been assumed to reduce direct capital costs by over $2 million in comparison to a wet fuel combustor. Use of gas rather than wood residue as fuel increases the total dryer fuel cost by approximately $12 per ton of pellets at the assumed costs of $9.50 per million BTU for natural gas and $22 per green ton for wood residue fuel.

Security of supply and the delivered cost of fibre along with the cost of natural gas fuel for drying are key factors that will drive project viability. The impact of changes for fibre and gas costs is shown on the following graphs. As indicated below, the fibre cost risk is significantly more important the natural gas cost risk.


Sensitivity to Fibre Costs
Base Case
$20.60/ton
Cost ($ per ton pellets)
180
160
140
120
100
80
60
40
20
0
15
20
25
30
35
40
45
50
Fibre ($ per green ton)
Total Cash Cost
Fibre


Sensitivity to Gas Cost
Base Case
$9.5/MMBTU
Cost ($ per ton pellets)
180
160
140
120
100
80
60
40
20
0
6
7
8
9
10
11
12
13
Natural Gas ($ per million BTU)
Total Cash Cost
Gas

7 FINANCIAL AND VIABILITY ANALYSIS

The Base Case assumes that the output would be sold to regional buyers with an average delivery cost of $20 per ton.

Sales Revenue and EBITDA		Domestic Sales			
		Bagged	Bulk	Total	Export
Production/sales	tons	50,000	20,000	70,000	
Delivered Price	$/MMBTU	12.00	10.80		10.80
Delivered Price	$/ton	200	180		180
Bagging	$/ton	20			
Delivery Cost	$/ton	20	20		65
Mill Net Revenue	**$/ton**	**160**	**160**	**160**	115
Manufacturing Cost	$/ton	105	105	105	105
EBITDA	**$/ton**	**55**	**55**	**55**	10
EBITDA	**$million/year**	**2.8**	**1.1**	**3.9**	0.0
EBITDA on Mill Net		35%	35%	35%	9%

EBITDA is Earnings before Interest, Taxes, Depreciation, and Amortization

The current wholesale price is about $200 per ton for premium grade pellets in 40-lb bags. It assumed that bulk sales, which would not incur the bagging cost, would provide the same mill net revenue. The tabulated domestic prices are equivalent to approximately $12.00 per million BTU for pellets in bags or $10.80 per million BTU in bulk.

Pellets could be sold to Europe during the months when the St Lawrence Seaway is not closed due to ice conditions and when domestic seasonal demand would be reduced. The delivered price to Europe was assumed at the current price of Euro 30 per MWh, which is equivalent to USD 180 per ton of pellets at the current exchange rate of USD 0.76 per Euro. However, even on a marginal basis at current pricing and cost levels, exports would not be viable and export sales are included in the above table only for a comparison.

Furthermore, the cost of transportation to Europe assumes that shipments can be loaded in ocean going vessels at Ontonagon with a cargo size of at least 18,000 tonnes loaded in about 72 hours. This may be difficult given the 19 ft (5.8 m) draft limit of the Ontonagon harbour. For smaller loads or if the pellets must be loaded at another port or transferred from a lake vessel to an ocean going vessel costs would be higher. Also, the analysis does not provide for storage or financial costs for accumulating inventory for export shipments.

The cost of regional delivery for domestic sales is based on an average haul distance of approximately 200 miles for $20 per ton. If favourable contracts can negotiated for bulk sales with be an industrial user such as White Pine Electric Power or Xcel Energy at Ashland, WI, transportation costs could be reduced to $12 or less per ton.

Total investment funding to establish a 70,000 ton per year pellet operation is estimated at approximately $18.5 million dollars. This value includes the estimated plant construction cost of $16 million plus provision for pre-project, financing, and start-up costs as well as provisions for working capital, but does not include acquisition of the site or stand-by financing.

Total Investment	**$ millions**
Facility Cost	16.00
Pre-project Costs	0.20
Air emission permit	0.10
Financing Costs	0.30
Start-up Costs	0.60
Initial Working Capital	1.30
Total Investment	18.50

Pre-project costs include feasibility studies and negotiating contracts for fibre supply, off-take contracts, power, gas, property purchase, and so on. The only permit that is expected to require significant effort and expense is the air emission permit from the State. Financing costs cover fees for arranging equity and debt and legal costs; the allowance is based on 1.5% of the investment. Depending on the circumstances, such fees could be significantly less, but they could also be higher.

Start-up costs include corporate organization and pre-operational expenses for hiring and training staff, and getting ready to take over the plant on mechanical completion. Owner's costs associated with managing and execution of plant construction are included in the Facility Costs. The provision for initial working capital assumes that there would be no cash receipts for the initial two months of operation.

If the pellet mill is a stand-alone operation, a reserve for operating losses would be prudent and would almost certainly be required if funding includes non-recourse debt financing. Operating losses could be incurred due to start-up problems or reduced revenues associated with lower than anticipated pricing or sales volumes.

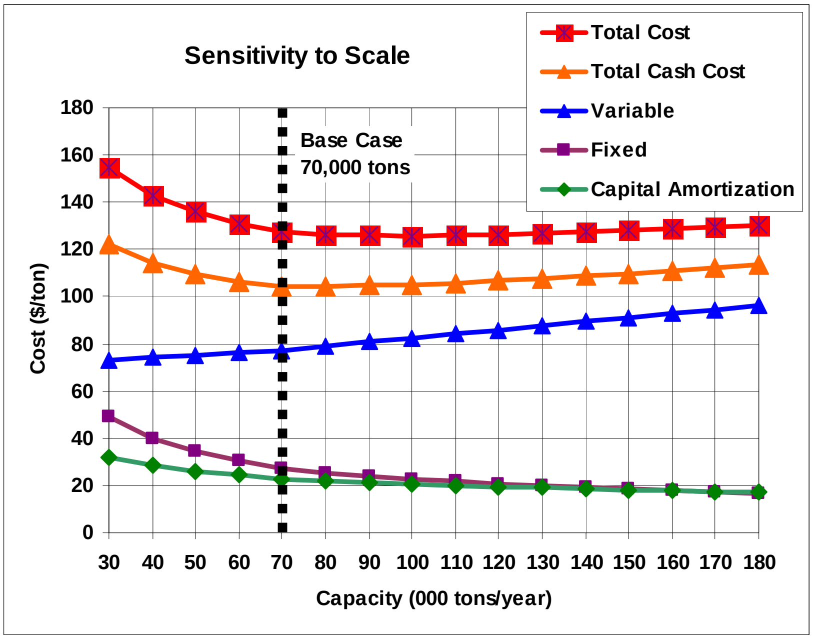
Annual EBITDA of approximately $3.9 million on an $18.5 million investment is equivalent to a Total Enterprise Value to EBITDA multiple of approximately 4.7, a reasonably attractive value for an industrial energy project.

And, there are possible strategies which could enhance viability, including:

- Long-term off-take agreements for "green fuel" with nearby power plants (White Pine Electric Power and Xcel Energy) or industrial plants. Such arrangements could reduce the transport cost for the finished product, facilitate use of bark or other raw material with higher ash content and a lower cost, and stabilize sales volumes and revenues.

- More favourable contracts for supply of wood residues from reliable sources close to the plant site with minimal transportation costs.
- Identification of appropriate used equipment; prime targets being the dryer and combustor.
- Maximization of benefits associated with location of the business in an Ontonagon County Renaissance Zone.

Sensitivity analysis with respect to capacity of the plant is based on reasonable (but arbitrary) assumptions for capital, fixed, and variable costs.



Assumptions used for the analysis illustrated by the above graph include:

Factor	Unit	30,000 tons/year	Base Case	180,000 tons/year
Facility Capital Cost	$ millions	10	16	30
Facility Capital Cost	$/ton/year	320	230	270
Cost of Capital		10%	10%	10%
Cost of Capital	$/ton pellets	32	23	17
Fibre Cost	$/ton pellets	33	37	56
Other Variable Costs	$/ton pellets	41	41	41
Fixed Operating Cost	$ million/year	1.5	1.9	3.0
Fixed Operating Cost	$/ton pellets	49	27	17
Total Manufacturing	$/ton pellets	155	127	131

As expected, economies of scale for a bigger plant significantly reduce the unit cost for investment amortization and fixed operating costs. However, for a plant in Ontonagon County fibre purchase costs and fibre transportation costs are expected to increase substantially for a larger facility as raw material must be transported to the pellet plant over longer distances, offsetting fixed cost savings.

Capacity of about 70,000 tons per year is a reasonable choice for a plant in Ontonagon County. A smaller plant could be attractive if innovative approaches for reducing plant construction cost, such as with utilization of used equipment, can be identified. A substantially larger plant is unlikely to be attractive given the regional availability of fibre.

EBITDA is most sensitive to fibre cost ($ per green ton) and mill net revenue ($ per ton at the mill fence). The table below shows EBITDA ($ per ton of pellets) related to these two key variables.

EBITDA ($/ton pellets)

Fibre Cost ($/green ton)	Mill Net Revenue ($/ton)				
	120	**140**	**160**	**180**	**200**
10	34	54	74	94	114
15	25	45	65	85	105
21	15	35	55	75	95
25	8	28	48	68	88
30		19	39	59	79
35		10	30	50	70
40		1	21	41	61
45			12	32	52
50			3	23	43

Base Case Values are shaded and negative values (associated with high fibre costs and low mill net revenues) are omitted.

Viability of the plant depends on mill net revenues very near, or above, the Base Case value of $160 per ton of bulk pellets and weighted average fibre costs that do not exceed $30 per green ton.

Appendices

1 Design Criteria

2 Drawings (under separate cover)
D-43B0097-111-6101 Overall Flow Diagram
D-43B0097-111-2001 Overall Site Plan

APPENDIX 1 DESIGN CRITERIA

Base Case - Gas Fuel

Basic Mass and Energy Balance Ontonagon Pellet Facility

Operating Period	d/a	350	
Operating Period	h/d	20	
Operating Period	h/a	7,000	
Pellet Production	tons/a	70,000	
Average pellet production	tons/d	200	
Average pellet production	tons/h	10	
Average pellet production	BDtons/h	9.5	
Fibre Supply for Pellets			
Raw material for pellets	BDton/ton pellets	0.98	
Raw material for pellets	BDtons/a	68,400	
Raw material moisture		45%	
Raw material for pellets	green tons/a	124,300	
Raw material for pellets	green ton/ton pellets	1.78	
Fuel Supply for Drying			
Fuel required	BDton/t pellets	0.00	
Fuel required	BDtons/a	0	
Fuel moisture		45%	
Fuel required	green tons/a	0	
Total Fibre Supply	green tons/a	124,300	
Coarse Hammer Mill			
Hammer mill utilization		70%	future, if required
Hammer mill design production	BDtons/h	14	
Hammer mill specific energy	kWh/BDton	25	
Hammer mill installed power (2)	hp	450	
Dryer			
Dryer utilization		75%	
Dryer design production	BDton/h	12.7	
Raw material solids		55%	
Raw material moisture		45%	
Moisture out		8%	reduced to 5% in pellet mill

Design Evaporation	lb/BDton	1,460
Design Evaporation	lb/h	18,000
Specific drying energy (HHV)	BTU/lb evap	1,450
Design heat to dryer	MMBTU/h	26
Average gas firing fraction		100%
Average gas fuel required	MMBTU/ton pellets	2.12
Wood fuel moisture		45%
Wood combustor efficiency		75%
Wood fuel HHV	BTU/dry lb	8,800
Combustor design heat release	MMBTU/h	35
Wood fuel required	BDton/ton pellets	0.00
Wood fuel required	green ton/ton pellets	0.00

Fine Hammer Mill and Screening

Hammer mill utilization		64%
Hammer mill design production	BDton/h	14.8
Hammer mill specific energy	kWh/BDton	20
Hammer mill installed power (2)	hp	400

Pellet Mills

Pellet mill utilization		73%	60% over 24 hrs
Pellet moisture content		5.0%	
Ash content		1.9%	
Pellet mill design production	tons/h	13.7	
Pellet mill specific energy	kWh/ton pellets	65	
Number of pellet mills		3	
Pellet mill installed power	hp	400	

Wood Losses

Wood yard		1.0%
Coarse screen		0.5%
Dryer		0.5%
Fines screen		0.5%
Cooler		0.5%
Total losses		3.0%
Total losses	BDton/ton pellets	0.029

APPENDIX 2 DRAWINGS

D-43B0097-111-6101 Overall Flow Diagram

D-43B0097-111-2001 Overall Site Plan