NWT Community Wood Pellet Study

Supply and Transport Options for Wood Pellets

September 2009

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For:

GWNT Environment and Natural Resources

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Executive Summary

Wood Pellets have been used for space heating in the NWT for at least ten years, primarily in the form of 18kg (40lb) bags for residential use, and mainly in Hay River, Fort Smith and Yellowknife. The success of the pellet boiler system at the North Slave Correctional Facility in Yellowknife, installed in November 2006, has led the way for many other commercial systems installed and planned in Yellowknife by the GNWT, The City of Yellowknife, and Northern Properties REIT. GNWT projects are also underway to bring automated bulk pellet commercial boiler systems to Behchoko, Hay River and Fort Smith.

All bulk pellets currently used in the NWT, and perhaps the majority of bagged pellets as well, come from La Crete Sawmill in La Crete, AB. The remainder comes primarily from BC pellet mills, Premium Pellet and Pinnacle Pellet. All bulk and bagged pellets from La Crete are trucked as there is no rail access in La Crete. All bagged pellets from BC are also trucked, as the increased cost of trucking over rail is offset by the relative ease of loading and unloading.

Moving bulk pellets by rail is generally much cheaper than trucking. However, CN Rail does not currently transport bulk pellets into the NWT, although they will transport pallets of bags as regular freight. It may be possible to negotiate with them to bring in substantial quantities in bulk; however, the estimated cost of transporting pellets by rail directly from pellet mills in BC to Hay River is slightly higher than the cost of transporting bulk pellets by truck from La Crete.

NTCL cannot currently handle bulk pellets for marine transport, and bagged pellets are treated as freight. It may be possible to handle 20' intermodal containers filled with loose bulk pellets; however, it is still cheaper to truck pellets to any community with an all-weather or winter road, than it is to barge at current freight rates. It may be possible to negotiate a bulk rate for wood pellets in large quantities, as is done with bulk fuel.

Wood pellets in bulk format present a substantially cheaper heating source when compared to heating oil and propane, for both all weather road and winter road resupply communities. Transport costs become more substantial as pellets are moved greater distances, however this also applies to a lesser extent to the alternatives, so the economics still favour wood pellets over heating oil in very remote NWT communities such as Tuktoyaktuk and Colville Lake.

Wood pellets are non-toxic and therefore eliminate the risk of costly and environmentally damaging fuel spills. They also have the added value of being considered carbon neutral, and therefore do not contribute to Climate Change which is having such a substantial impact on the NWT's fragile environment.

Although no bulk pellets from BC mills are currently being brought into the NWT, this could be the cheapest pellet source for communities accessed via the Dempster Highway, and could also provide an alternate supply of bulk pellets that is still cheaper than fossil fuels in the case of a supply disruption from La Crete.

Introduction

The Arctic Energy Alliance was contracted by the Department of Environment and Natural Resources (ENR) of the Government of Northwest Territories (GNWT) to provide a study identifying which communities are best suited for increased use of wood pellets for space heating. The original focus was on bulk pellets for commercial heating systems in small communities; particularly those served by Petroleum Products Division. This was expanded to include bagged pellets for residential pellet stoves. This document will provide part of the background information required for the government's Biomass Strategy. Part 1 of the study (this document) investigates the possible wood pellet supply locations, transportation methods, and delivered costs of providing Northwest Territories' (NWT) communities with a renewable fuel alternative to heating oil. Part 2 of the study will investigate possible scenarios for community scale wood pellet central heating facilities with district heating systems, including economics and technical and logistical challenges.

Arctic Green Energy and Peter Brand were sub-contracted to provide technical expertise in the development of this study.

1.0 What Are Wood Pellets?

Wood pellets are small hard cylinders of highly compressed wood. They are made entirely from sawdust or shavings; they do not contain additives of any kind. Wood pellets are between 6 millimetres (mm) (¼ inch) and 8mm (5/16 inch) diameter and less than 38mm (1 ½ inch) in length[1]. They tend to hold their shape very well, but will begin to break apart with too much handling or transferring. If they get wet they will crumble back into sawdust. The primary benefit of wood pellets is that they have a much higher density than sawdust which means they take up less space and that allows for more economical transportation and handling. They also flow much easier than sawdust and have uniform heat and moisture content, allowing for consistent burning conditions. Wood Pellets have density of at least 641 kg/m^3 (40 lbs/ft3) [2].

Wood pellets are a fuel just as heating oil, propane and natural gas are. Unlike fossil fuels, wood pellets are a renewable resource as they originate from trees, but they have the added environmental advantage of being a reused waste product.

Currently no live trees are cut down in Canada to make wood pellets, as this would be much more expensive for companies than using waste sawdust.[3] Sawdust used to be considered a waste product created by producing lumber and was burned or landfilled. It is now increasingly salvaged and turned into pellets, as a secondary revenue stream for sawmills, helping forest companies to remain competitive. As the available supply of sawmill residuals becomes fully utilized, wood pellet producers are beginning to access other forms of feedstock such as logging slash – a product that has been burned in the past.

1.1 Energy Content of Wood Pellets

The following table compares the energy content of different fuels used for heating[4]. This does not take into account the efficiency of the appliance used to burn the fuel.

Energy content of Heating Fuels		
Wood Pellets	19,700	MJ per tonne
Heating Oil	38.4	MJ per litre
Propane	26.6	MJ per litre
Cordwood	19,800	MJ per cord
Natural Gas	1,000	MJ per GJ
Natural Gas	1,062	MJ per Mcf

For comparison, 1 tonne (1000kg) of wood pellets contains the energy equivalent of:

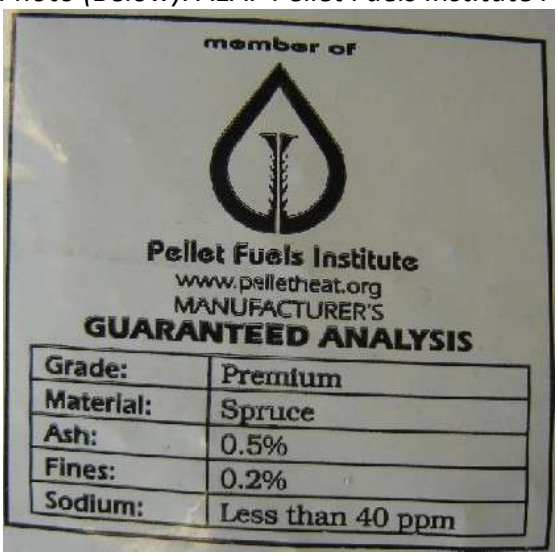
513	litres of Heating Oil
741	litres of Propane
0.99	cords of Wood
19.7	GJ of Natural Gas
18.5	Mcf of Natural Gas

[1] Pellet Fuels Institute, http://www.pelletheat.org/3/industry/index.html
[2] Pellet Fuels Institute, http://www.pelletheat.org/3/industry/index.html
[3] Wood Pellet Association of Canada, http://www.pellet.org/Site/Forms/ViewPage.aspx?PageID=318
[4] Values from RETScreen software

1.2 Pellet Grades

The pellet fuel industry, through the Pellet Fuels Institute, has developed standards for wood pellets[5]. These industry standards assure as much uniformity as possible. PFI-graded fuel must meet tests for Density, Dimensions, Fines, Chlorides, and Ash content. The PFI has two grades of pellets, Premium and Standard. The only difference between the two grades is in the ash content of the pellets. Standard grade pellets produce less than 3% ash when burned, while Premium pellets produce less than 1% ash. The Premium grade of pellet is recommended to reduce the amount of ash removal that is required. Most pellets produced in western Canada, from softwood feedstock, exceed the Premium standard.

Photo (Below): AEA. Pellet Fuels Institute Premium Grading Analysis on pellets from La Crete Sawmills.



1.3 Wood Pellets and the Environment

As mentioned, wood pellets are a renewable resource. They are also non-toxic so that there is no environmental damage if a spill occurs, unlike heating oil which can be extremely costly to clean up when spilled due to its toxic and flammable nature. Because wood pellets are made from trees that absorb carbon as they grow back, they are not considered to add Greenhouse Gases to the atmosphere, which are considered to be responsible for Climate Change. For many years in Europe and more recently in North America, carbon taxes are being implemented to reduce greenhouse gas emissions. In the recently implemented BC carbon tax, fuel oil is taxed at 2.76 cents per litre, rising to 8.27 cents per litre in 2012. Because wood pellets are considered carbon-neutral, they are not affected by carbon taxes.

[5] Pellet Fuels Institute, http://www.pelletheat.org/3/industry/index.html

2.0 The Wood Pellet Market

2.1 The Worldwide Wood Pellet Market

The worldwide wood pellet market is currently experiencing rapid growth, both in production and consumption. The increasing demand has been driven mainly by the high prices of fossil fuels over the last few years combined with an increasing awareness of the necessity of combating climate change by using renewable energy, which has caused many European governments to mandate renewable energy requirements. Worldwide pellet production was estimated at about 0.1 million tonnes in 1980, and had grown to about 10 million tonnes in 2008.[6] This represents a 100 times increase in less than 30 years, a steady growth rate of about 18% per year. The rapid growth is expected to continue, with production anticipated to possibly reach 15 million tonnes worldwide by 2010. [7]

2.2 The Canadian Wood Pellet Market

The Canadian growth rate in production and consumption of wood pellets is symmetric with the worldwide situation. The 2008 Canadian wood pellet production from 32 pellet mills was approx. 2 million tonnes, and is expected to increase to 3 million tonnes per year by 2010.[8]

Most Canadian pellets are exported to Europe because a strong domestic market hasn't been created yet, and European governments have mandated minimum percentages of renewable energy, called Renewable Portfolio Standards, something that hasn't happened in Canada yet.

Canadian pellet manufacturers are receiving frequent requests, mainly from the Northeast United States and Europe, for quantities ranging up to hundreds of thousands of tonnes.[9] North-eastern US and Europe are the markets that import 80 per cent of Canada's production.[10] Even on Canada's west coast, many large manufacturers have entered into multi-year supply contracts with customers in Europe.[11]

Annual production from one producer (Pinnacle Pellet Inc., 700,000 tonnes[12]) would be more than twice the amount required to heat every residence and every commercial and government building in the Northwest Territories.

The major Canadian pellet producers are actively searching for Canadian markets and the North (including Yellowknife) shows considerable market potential.

[6] BioEnergy 2008 Conference, presentation: Production and Market Trends
[7] BioEnergy 2008 Conference, presentation: Production and Market Trends
[8] BioEnergy 2008 Conference, presentation: Canadian Pellet Production for Worldwide Markets
[9] La Crete Sawmills & Arctic Green Energy, conversation
[10] BioEnergy 2008 Conference, presentation: Canadian Pellet Production for Worldwide Markets
[11] Pinnacle Pellet, conversation
[12] BioEnergy 2008 Conference, presentation: Canadian Pellet Production for Worldwide Markets

2.3 The Current NWT Pellet Market

Based on conversations with producers, retailers, and consumers, the current NWT wood pellet market is estimated at about 10,000 tonnes per year (equivalent to about 5,000,000 litres of heating fuel), with the majority of that being bulk pellets for commercial boiler systems in Yellowknife and perhaps 10% being bagged pellets for residential pellet stoves. This amount is expected to grow substantially in the next few years as more planned commercial systems come on, several of which are already in the design or construction stages.

2.4 NWT Pellet Market Potential

If every public and private building in Yellowknife was heated by wood pellets the demand would be roughly 200,000 tonnes per year.[13] It is estimated that all of the heating requirements in NWT communities could be met by roughly 320,000 tonnes of wood pellets per year (see Appendix 1 for a breakdown). This does not include mines or oil and gas activity. When compared to the current pellet use, this suggests the pellet market has the potential to increase dramatically.

Regional markets closer to manufacturers are more desirable but have yet to be fully developed. Pellet manufacturers have an eye on the future and know that when the economy improves, closed lumber mills will reopen and will likely enter the pellet manufacturing business.[14] As such, manufacturers are eager to cultivate demand in their own "back yard."

[13] Yellowknife Community Energy Plan – Energy and Emissions Baseline 2006
[14] Pacific BioEnergy & La Crete Sawmills, conversation

3.0 Wood Pellet Packaging

Wood pellets are sold wholesale and retail in three different forms. The smallest is the 18 kilogram (40 pound) plastic bag. This is the most common method for selling pellets retail to the residential market. Pellets are also commonly sold in one tonne (metric) bags made of durable woven plastic. The third type is loose bulk, which has no packaging, and is used for large quantities.

3.1 Eighteen Kilogram (Forty Pound) Bags

For the residential pellet stove market, the 18kg bag is used almost exclusively. The package is designed to be easily handled by one person for filling stove hoppers. The downside of this format is the large number of plastic bags that are thrown away after use. In Europe some brands have switched to a biodegradable bag made of cornstarch. However, this has not caught on in North America yet.

Photo (Below): AEA. Wood Pellets in 18 kg bags bought from Yellowknife retailers.

Eighteen kg bags are transported to retail outlets or consumers on wooden pallets usually holding between 50 and 70 bags. The number of bags of pellets per shipping pallet can vary amongst manufacturers.

The individual bags are waterproof so long as they are not punctured, however some manufacturers use a perforated bag to allow for more uniform stacking. Pallets are further wrapped with two layers of plastic and often a full plastic cover to ensure easy handling and that pellets are not exposed to moisture, which will ruin the pellets. Reports have been received that ravens will pick through the layers of plastic to the pellets, thus exposing them to snow or rain.[15] Placing plywood sheets over the pallets seems to deter them; however, indoor storage is preferable to ensure that pellets in this form of packaging aren't damaged.

Palletized 18kg bags of pellets are the most expensive form to purchase wood pellets due to the increased handling and packaging required at the mill, but have the advantage over other packaging as they only require a forklift / small loader to handle, which every community has access to.[16] They can be stacked three pallets high (see photo below) to maximize storage and transport volume. Furthermore, all mills use this size of packaging.

[15] Taylor & Company, conversation
[16] NTCL, conversation

Photo (Below): AEA. Wood Pellets in 18 kg bags on pallets stacked at La Crete Sawmills.

3.2 One Tonne Bags

Mills often use one tonne bags or "Super Sacks" to sell pellets. These bags allow larger volumes of pellets to be handled and are suited for larger residential or small commercial pellet heating systems. Individual Super Sacks can be palletized or moved around directly by forklift as they have strap handles (see photo below). The barge company, NTCL, however, suggested that they would use an add-on hook device (attached to the forks of the loader) to lift Super Sacks. In this case, in addition to the loader operator, staff would also be required to handle the hook device.[17] Some one tonne sacks have an opening at the bottom of the bag with a drawstring that can be used to empty the contents into another storage container (see photo below). Some mills offer a refund for returning the sack to be reused, for example La Crete sawmills offers a $30 refund. Pellets in SuperSacks are sometimes cheaper than palletized 18 kg bags at the mill; however, some mills charge the same price per tonne.

[17] NTCL, conversation

Photo (left): AEA. Wood Pellets in one tonne bags on storage pallets at La Crete Sawmills in La Crete, AB.
Photo (right): AEA. Wood Pellets in one tonne bag emptying into hopper at Premium Pellet in Vanderhoof, BC.

3.3 Loose Bulk

Mills often have the capacity to sell wood pellets as loose bulk. Some mills have a rail line at their site and will fill grain rail cars directly (see photo below). Some larger mills in BC transport pellets via rail to a port on the West coast to be transported via ship to Europe. Alternatively, La Crete Sawmills fills grain trucks and transports the pellets to the retailer, or even to the end user in the case of large commercial systems. Wood pellets share transportation and handling characteristics with grain.[18] They mustn't get wet, can be transported and transferred by grain handling equipment, and are moved by auger, gravity feed, or pneumatic systems. They can be stored in grain silos. With minimal handling and no packaging, a mill's cheapest per tonne price is obtained with loose bulk.

Wood Pellets in loose bulk form can even be delivered directly to residential customers in smaller quantities of only a few tonnes, provided they have a suitable receptacle, through the use of special pneumatic or auger delivery trucks. This service is very common in Europe, and is currently available in Yellowknife through Arctic Green Energy.

[18] Arctic Green Energy, conversation

Photo: AEA. Rail car being filled with bulk pellets at Premium Pellet, Vanderhoof.

3.4 Intermodal Containers

Another possible method of transporting pellets is via intermodal containers, which come in 20, 40, and 53 foot lengths. The benefits of intermodal containers are that they are standard units for transportation of all types of goods, they can be handled easily by common equipment, and can be moved by rail, trucks or ships. It is also possible to use the containers as integral storage at the point of use.[19] While this is not currently being done, it may prove to be a successful method of transporting pellets in remote communities. The drawback is that the containers are expensive to purchase, and would have to be sold or shipped back out once empty. A 20 foot container can hold a maximum of 16 tonnes, but is limited to 9 tonnes in many communities due to the equipment available for handling.[20]

Photo: AEA. Twenty foot intermodal containers in NTCL's yard in Hay River.

[19] Arctic Green Energy, conversation
[20] NTCL, conversation

4.0 Wood Pellet Transportation Methods

The most economic shipping method for NWT communities is dependent not only on geography, but also on the packaging available for wood pellet purchase. Pellets can potentially be shipped to and throughout the NWT by truck, rail and barge. Ships loaded with pellets from Quebec were also considered for the Inuvialuit communities.

4.1 Truck

For the purposes of transportation, wood pellets are essentially identical to grain. The most common method of trucking pellets in bulk is using Super B-train grain trucks, which is an 8-axle configuration with two trailers being pulled by one truck, and can haul a maximum of 44 tons. This is more economical than the standard 5-axle semi-trailer configuration. In the case of pallets of bagged pellets, they are treated as freight and transported in standard freight trailers.

The B-train configuration's strength on all-weather roads is also a weakness if ice roads are to be travelled. Due to the load restrictions on the ice roads, truckers have to unlatch the second trailer section and first deliver the first trailer section. Once the A section is unloaded, they return to the start of the winter road with the A container empty to retrieve the B container and continue to the delivery point. In -40 Celsius (C) weather, additional delays can arise due to leaving the second trailer's air breaks without power, allowing them to freeze. Antifreeze has to be flushed through the breaking system to remove the ice build up when re-attaching. Of course these same issues arise with delivery of fossil fuel products.

Grain trucks can employ one of three feeding methods: gravity, auger or pneumatic (forced air). Several "in-town" delivery trucks are shown below.

Photo (left): AEA. Arctic Green Energy's pneumatic feed truck used for commercial delivery.
Photo (right): AEA. Northern Properties REIT's auger feed truck used for private delivery. Note the intermodal container used for pellet storage.

Photo: AEA. La Crete's auger feed truck used for local delivery.

4.2 Train

Wood pellets can be transported by train in intermodal containers, as freight in rail cars or as loose bulk in grain cars. Some pellet mills throughout Canada have a rail spur on their property so that grain cars can be directly filled with bulk pellets. Unfortunately, according to CN, grain cars and intermodal containers are not currently brought up the line to Hay River from Alberta.[21] Therefore the only way to transport pellets into the NWT by rail is on pallets as regular freight, either in 1 tonne bags or 18kg (40lb) bags.

The base prices for rail transport are incomplete shipping costs as they do not include: unloading, blocking, bracing and cartage (from mill to rail line).[22] Due to time consuming and expensive handling at destination and origin, it is likely in the immediate future that the benefits (and total shipping costs) of trucking will outweigh the seemingly attractive base rail prices. A retailer in Hay River had shipped pellets by rail but decided to revert back to trucking due to the inconvenient arrival time of the train, and high logistic costs. This sentiment has been echoed by other companies in the NWT pellet industry.

Train service still has potential in the NWT especially when significant quantities of bulk pellets are being shipped.[23] NTCL has a rail spur on their yard, which can be unloaded by their own staff. Goods can be stored in their yard until the barge is ready to journey up the Mackenzie River.[24]

[21] CN, conversation
[22] CN, conversation
[23] Pacific Bioenergy, Peter Swaan, conversations
[24] NTCL

4.3 Barge

NTCL services Lutselk'e and the Mackenzie River and Arctic communities of the NWT. Currently, NTCL does not have the capacity to transport pellets in loose bulk which would allow for the cheapest pellet per tonne mill price. It may be possible that as NTCL adopts double hulled craft in order to transport oil, single hulled barges could be used to transport loose pellets.

NTCL Barges leave from Hay River, so pellets have to be brought to Hay River by trucks (or possibly trains at some point). NTCL fees for regular freight are charged per kilogram. A 10 per cent discount is automatically applied for any shipment over 18 tonnes. The strapping fee is waived as the super sacks will arrive already palletized. Finally a three per cent fuel surcharge is added, and GST is not added as it is assumed the GNWT will be making the purchase.

In the barge-only communities, savings will be realized by heating with wood pellets by instead of heating oil. However, until better barge transport rates are negotiated for bulk quantities, trucking bulk pellets via all-weather or ice road is cheaper than shipping wood pellets by barge for all communities with road access.

Photo: AEA. An NTCL loader which would be used in Hay River and communities to move palletized one tonne bags.

4.4 Ship

Preliminary investigations of shipping pellets by Nunavut Sealink & Supply Inc. (NSSI) from Quebec via ship to Uluhaktuk, Paulatuk, Sachs Harbour and Tuktoyaktuk showed that it may be a long term option. The port of Montreal no longer handles loose bulk materials but a smaller port near Montreal, which NSSI frequents, does. Similar to NTCL, NSSI does not require a port to deliver its goods. The ships are equipped with small barges which ferry goods from the anchored ship to the shore. NSSI loaders can deliver the beached goods in town. The company doesn't currently operate in the western Arctic but is eager to expand operations.

At the time of writing, NSSI is not ready to accept orders for NWT Arctic communities.

5.0 Pellet Supply Options for the NWT

Most wood pellets in the NWT, especially in Yellowknife, originate from La Crete Sawmills in La Crete, Alberta. La Crete is 117 km from High Level, AB, 428 km from Hay River, and 833 km from Yellowknife. La Crete Sawmills has been in operation since 1989. They entered in the premium pellet manufacturing business in 2003. La Crete Sawmills had been producing about 30,000 tonnes of pellets per year until recently when they expanded to almost triple their output capacity. An abrupt interruption of the pellet supply from La Crete would affect the economic feasibility of bulk pellet heat in the NWT since other sources may be available but at a greater transportation cost.

A gradual increase in consumption in Yellowknife and other NWT communities and Northern Alberta would allow for the construction of alternative pellet mills which could service this market. The Prince George area in BC is one of the main pellet producers in Canada and the world. Currently, only wood waste is used for pellet production but pellet producers in the BC interior have access to huge swathes of pine beetle infested areas with potentially almost unlimited amounts of pellet raw material.

Retailers in Hay River and Yellowknife sell bagged pellets from Pinnacle Pellet, which has five manufacturing sites in BC, and Premium Pellet located in Vanderhoof, BC. Pinnacle Pellet produces about 700,000 tonnes per year, and Premium Pellet produces approximately 130,000 tonnes per year.

Another less common brand of pellets (in terms of quantity sold in Yellowknife) is that of Fireside Ultra manufactured by Dansons, located in Acheson, AB.

A brand of pellet called Lignetics is available at Canadian Tire in Yellowknife. These pellets come from Idaho or Virginia. Considering the high cost of transportation, it is unclear how pellets can be cost-effectively transported such a great distance.

5.1 Pellet Sources and Costs

The following table shows some pellet producers in Alberta and BC, and the prices of pellets in various forms at the mill:

Wood Pellet Sources					
Mill	Location	Cost of Bulk ($/t)	Cost of 1 Tonne bag ($/t)	Cost of 18kg Bags ($/bag) by the skid at the Mill	Cost of 18kg Bags ($/t) by the skid at the Mill
Alberta					
Danson's Group	Edmonton	N/A	N/A	$4.99	$274
Foot Hills	Foot Hills	N/A	N/A	$3.30	$182
La Crete Sawmills	La Crete	$115	$145	$3.91	$215
British Columbia					
Pinnacle Pellet	Quesnel	$160	$180	$3.61	$199
Premium Pellet	Vanderhoof	$105	$135	N/A	N/A
Pacific Bioenergy	Prince George	$110	N/A	N/A	N/A
LNR, Princeton Co-gen	Princeton	$110	N/A	$3.24	$178
LNR, WestWood Fibre	Kelowna	N/A	N/A	$2.99	$164

The chart below uses Hay River as the shipping destination to compare the landed cost of pellets. Foot Hills does not sell pellets in loose bulk but will sell by the one tonne bag with a large order. Pacific Bioenergy only sells large quantities in loose bulk. As discussed in previous sections, both types of packaging have advantages and disadvantages.

Comparison of Estimated Landed Cost of Pellets in Hay River from Different Sources						
Transportation	**Pellet Mill**	**Location**	**Packaging**	**Transport Cost ($/t)**	**Landed Cost of Pellets ($/t)**	**Equivalent Oil Cost ($/L)**
Truck	La Crete	La Crete	Loose Bulk	$35	$150	$0.29
Truck	Foot Hills	Foot Hills, AB	1 t bags	$90	$272	$0.53
Truck	Pacific Bioenergy	Prince George, BC	Loose bulk	$73	$183	$0.36
Truck	Premium pellet	Vanderhoof, BC	1 t bags	$79	$214	$0.42
Truck	Premium pellet	Vanderhoof, BC	Loose bulk	$79	$184	$0.36
Rail (Freight Car)	Foot Hills	Foot Hills, AB	1 t bags	$49	$231	$0.45
Rail (Freight Car)	Pinnacle pellet	Quesnel, BC	1 t bags	$56	$236	$0.46

Although one tonne bags shipped by freight cars do not require special handling facilities, they do require intermittent storage or strong logistical organization in order to immediately load them onto trucks for their final destination.[25]

[25] CN, Arctic Green Energy

Although CN will not currently bring grain cars into the NWT, if this were to change, and the proper handling facilities put in place in Hay River to handle rail shipments of bulk pellets into the NWT, the delivered cost of pellets by rail from BC mills could become comparable to those associated with trucking pellets from La Crete as shown following:

Estimated Cost of Pellets in Hay River in Loose Bulk By Rail						
Transportation	**Pellet Mill**	**Location**	**Packaging**	**Transport Cost ($/t)**	**Landed Cost of Pellets ($/t)**	**Equivalent Oil Cost ($/L)**
Rail (Grain Car)	Premium pellet	Vanderhoof, BC	Loose bulk	$55	$160	$0.31

6.0 Community Wood Pellet Cost Comparison

The following tables show the delivered cost of pellets in each community compared to the recent cost of heating fuel, and also compared to the heating fuel cost at the peak price of May 2008.

6.1 Bulk Pellets By Truck

The following tables show the estimated cost of bulk pellets delivered by truck to all NWT communities with road access. The first table shows estimated delivered costs of bulk pellets from La Crete Sawmills in La Crete, AB, and the second table shows estimated delivered costs of bulk pellets from Premium Pellet in Vanderhoof BC.

The tables show that the greater the distance between a community and the pellet mill, the higher the landed cost of pellets will be. In many cases the transport cost is considerably higher than the cost of the pellets at the mill. This means that the further a community is from a source of pellets, the more expensive oil has to be in order to yield financial savings from the adoption of wood pellets. As trucking via winter roads is more expensive due to the slower travelling speed, a community closer to the pellet mill but connected in part by ice road may have a higher delivered cost than an all-season road access community further from the mill.

It can also be seen from the charts that trucking pellets from La Crete results in a lower landed cost for the North Slave and South Slave Regions, while trucking from BC mills results in a lower delivered cost in Fort Liard, and all communities accessed via the Dempster Highway through the Yukon. The remaining Deh Cho communities, and all communities accessed via the Mackenzie Valley winter road have similar costs from either source.

For trucking bulk pellets from La Crete, the rates used, including fuel rider, were $0.082/t/km for paved roads, $0.093/t/km for unpaved roads, and $0.23/t/km for winter roads. La Crete Sawmills handles the bulk trucking of their pellets with their own trucks, and provided the above rates. These rates are per loaded km (one way distance).

For trucking bulk pellets from Vanderhoof, the rates used were $0.058/t/km for paved roads, $0.069/t/km for unpaved roads, and $0.23/t/km for winter roads. The rate for paved highway was provided by a BC trucking company through Pinnacle Pellet, and the rates for unpaved and winter roads were estimated.

Estimated Cost of Bulk Wood Pellets Compared to Heating Fuel
NWT Road Access Communities (Trucking from La Crete, AB)

	Total km from La Crete, AB	Bulk Landed Cost of Pellets ($/tonne)	Equivalent Cost of Heating Oil ($/L)	Cost of Heating Oil ($/L) (May 2008)	Cost of Wood Pellets as a % of Cost of Heating Fuel (May 2008)	Cost of Heating Oil ($/L) (May 2009)	Cost of Wood Pellets as a % of Cost of Heating Fuel (May 2009)
All Weather Road Communities							
Enterprise	389	$147	$0.29	$1.28	23%	$0.83	35%
Hay River (Propane	428	$150	$0.20	$0.68	30%	$0.73	28%
Kakisa	432	$151	$0.29	$1.35	22%	$0.83	35%
Fort Providence	472	$154	$0.30	$1.39	22%	$0.94	32%
Fort Resolution	515	$158	$0.31	$1.35	23%	$0.90	34%
Fort Smith	632	$168	$0.33	$1.21	27%	$0.81	40%
Jean Marie River*	707	$175	$0.34	$1.24	28%	$0.94	36%
Behchoko	736	$175	$0.34	$1.24	28%	$0.83	41%
Fort Simpson	902	$189	$0.37	$1.33	28%	$0.88	42%
Yellowknife	833	$183	$0.36	$1.22	29%	$0.79	45%
Fort Liard	935	$197	$0.38	unavailable	unavailable	$0.86	45%
Wrigley*	994	$201	$0.39	$1.49	26%	$1.20	33%
Fort McPherson	3,020	$368	$0.72	$1.27	57%	$1.10	65%
Tsiigehtchic*	3,076	$374	$0.73	$1.36	54%	$1.21	60%
Inuvik (Gas)	3,202	$385	$19.60	$18.77	104%	$20.60	95%
Winter Road Resupply Communities							
Trout Lake*	751	$200	$0.39	$1.50	26%	$1.09	36%
What'i*	839	$201	$0.39	$1.41	28%	$0.98	40%
Nahanni Butte*	866	$194	$0.38	$1.54	24%	$1.06	36%
Gameti*	930	$224	$0.44	$1.46	30%	$1.11	39%
Wekweeti*	1,028	$249	$0.49	$1.61	30%	$1.19	41%
Tulita*	1,276	$265	$0.52	$0.99	52%	$1.25	41%
Deline*	1,357	$286	$0.56	$1.36	41%	$0.99	56%
Norman Wells (Gas	1,361	$287	$15.51	$8.85	175%	$14.00	111%
Norman Wells (Oil)	1,361	$287	$0.56	$1.33	42%	$0.84	67%
Fort Good Hope*	1,508	$324	$0.63	$1.30	49%	$1.24	51%
Colville Lake*	1,658	$362	$0.71	$1.56	45%	$1.22	58%
Aklavik	3,318	$415	$0.81	$1.57	52%	$0.90	90%
Tuktoyaktuk	3,396	$435	$0.85	$1.53	55%	$1.60	53%

* PPD communities

The following exceptions to heating oil are highlighted in yellow above:

Hay River, Propane is sold by the litre, prices listed $ / L

Norman Wells (Gas), Natural Gas sold by 1000 cubic feet (Mcf), prices listed $ / Mcf

Inuvik, Natural Gas sold by energy content (GJ), prices listed $ / GJ

Estimated Cost of Bulk Wood Pellets Compared to Heating Fuel
NWT Road Access Communities (Trucking from Vanderhoof, BC)

	Total km from Vanderhoof	Bulk Landed Cost of Pellets ($/tonne)	Equivalent Cost of Heating Oil ($/L)	Cost of Heating Oil ($/L) (May 2008)	Cost of Wood Pellets as a % of Cost of Heating Fuel (May 2008)	Cost of Heating Oil ($/L) (May 2009)	Cost of Wood Pellets as a % of Cost of Heating Fuel (May 2009)
All Weather Road Communities							
Enterprise	1,282	$179	$0.35	$1.28	27%	$0.83	42%
Hay River (Propane)	1,365	$184	$0.25	$0.68	36%	$0.73	34%
Kakisa	1,423	$187	$0.36	$1.35	27%	$0.83	44%
Fort Providence	1,467	$190	$0.37	$1.39	27%	$0.94	39%
Fort Resolution	1,509	$193	$0.38	$1.35	28%	$0.90	42%
Fort Smith	1,623	$201	$0.39	$1.21	32%	$0.81	48%
Jean Marie River*	1,394	$189	$0.37	$1.24	30%	$0.94	39%
Behchoko	1,678	$202	$0.39	$1.24	32%	$0.83	47%
Fort Simpson	1,435	$191	$0.37	$1.33	28%	$0.88	42%
Yellowknife	1,770	$207	$0.40	$1.22	33%	$0.79	51%
Fort Liard	1,156	$172	$0.34	unavailable	unavailable	$0.86	39%
Wrigley*	1,657	$206	$0.40	$1.49	27%	$1.20	33%
Fort McPherson	2,557	$259	$0.50	$1.27	40%	$1.10	46%
Tsiigehtchic*	2,612	$262	$0.51	$1.36	38%	$1.21	42%
Inuvik (Gas)	2,738	$271	$13.76	$18.77	73%	$20.60	67%
Winter Road Resupply Communities							
Trout Lake*	1,592	$222	$0.43	$1.50	29%	$1.09	40%
What'i*	1,781	$225	$0.44	$1.41	31%	$0.98	45%
Nahanni Butte*	1,366	$189	$0.37	$1.54	24%	$1.06	35%
Gameti*	1,872	$246	$0.48	$1.46	33%	$1.11	43%
Wekweeti*	1,970	$268	$0.52	$1.61	32%	$1.19	44%
Tulita*	1,905	$263	$0.51	$0.99	52%	$1.25	41%
Deline*	1,986	$281	$0.55	$1.36	40%	$0.99	55%
Norman Wells (Gas)	1,990	$282	$15.20	$8.85	172%	$14.00	109%
Norman Wells (Oil)	1,990	$282	$0.55	$1.33	41%	$0.84	66%
Fort Good Hope*	2,137	$315	$0.61	$1.30	47%	$1.24	50%
Colville Lake*	2,287	$350	$0.68	$1.56	44%	$1.22	56%
Aklavik	2,854	$297	$0.58	$1.57	37%	$0.90	64%
Tuktoyaktuk	2,932	$315	$0.61	$1.53	40%	$1.60	38%

* PPD communities

The following exceptions to heating oil are highlighted in yellow above:

Hay River, Propane is sold by the litre, prices listed $ / L

Norman Wells (Gas), Natural Gas sold by 1000 cubic feet (Mcf), prices listed $ / Mcf

Inuvik, Natural Gas sold by energy content (GJ), prices listed $ / GJ

6.2 One Tonne Bagged Pellets By Barge/Ship

The following chart shows the communities serviced by NTCL and the delivered cost of wood pellets in one tonne bags shipped wholesale directly from the mill compared to the cost of heating oil. The shipping details column shows the port of origin (R: Richmond, HR: Hay River) and how the shipping fee would be calculated. The cheapest available shipping option from NTCL is shown for each community and included in the Landed Cost of Pellets. For wholesale quantities of palletized 18kg bags, the transport cost will be the same but the cost at the mill will be higher (see section 5.1), so the landed cost listed below will increase by $70/t for pellets from La Crete shipped through Hay River, and by only $6 per tonne for pellets from BC shipped through Richmond, as 18kg bags can be sourced from LNR in Kelowna which is closer to Richmond than Premium in Vanderhoof where 1t bags are sourced.

As can be seen, in most cases wood pellets in this format represent a cost savings over heating oil, however it should be noted that in all communities with winter road access pellets can be supplied in bulk by truck at a much lower landed cost, see section 6.1 above.

Estimated Cost of Wood Pellets Compared to Heating Fuel
One Tonne Bags by NTCL Freight

NTCL Communities	Shipping Details	Landed Cost of Pellets ($/tonne)	Equivalent Cost of Heating Oil ($/L)	Cost of Heating Oil ($/L) (May 2008)	Cost of Wood Pellets as a % of Cost of Heating Fuel (May 2008)	Cost of Heating Oil ($/L) (May 2009)	Cost of Wood Pellets as a % of Cost of Heating Fuel (May 2009)
Tuktoyaktuk	R, Container, Mass	$517	$1.01	$1.53	66%	$1.60	63%
Sachs Harbour*	R, Freight, Mass	$590	$1.15	$1.28	90%	$1.38	83%
Paulatuk*	R, Freight, Mass	$590	$1.15	$1.26	91%	$1.38	83%
Ulukhaktok*	R, Freight, Mass	$590	$1.15	$1.19	97%	$1.38	83%
Norman Wells (Gas)	HR, Freight, Mass	$415	$22.35	$8.85	253%	$14.00	160%
Norman Wells (Oil)	HR, Freight, Mass	$415	$0.81	$1.33	61%	$0.84	96%
Tulita*	HR, Freight, Mass	$415	$0.81	$0.99	82%	$1.25	65%
Lutsel K'e*	HR, Freight, Mass	$422	$0.82	$1.08	76%	$1.29	64%
Tsiigehtchic*	HR, Freight, Mass	$501	$0.98	$1.36	72%	$1.21	81%
Aklavik	HR, Freight, Mass	$501	$0.98	$1.57	62%	$0.90	108%
Inuvik (Gas)	HR, Freight, Mass	$501	$25.41	$18.77	135%	$20.60	123%

* PPD communities

The following exceptions to heating oil are highlighted in yellow above:

Norman Wells (Gas), Natural Gas sold by 1000 cubic feet (Mcf), prices listed $ / Mcf

Inuvik, Natural Gas sold by energy content (GJ), prices listed $ / GJ

10% discount applies on shipments greater than 40,000 lbs (18.1 mton), has been assumed in the above calculations.

Mill Cost of Pellets for Barge communities includes the extra $30 per tonne for the supper sack

No Strapping charge ($0.015/lbs) would apply if the freight is already palletized.

Hay River 'dock' price of La Crete pellets (1t bag): $177

Richmond 'dock' price of Premium pelelts (1t bag): $181

6.3 Retail 18kg Bagged Pellets by Freight

The following table shows the estimated delivered cost of palletized 18kg (40lb) bags, purchased retail, to NWT communities at commercially available freight rates. Communities where regular freight transport is not currently provided are not included.

It can be seen from the chart that trucking pellets as standard freight does not provide an economic alternative to heating oil, however for wholesale customers willing to order an entire truckload of bags transported directly from La Crete the landed cost will be about $100 per tonne higher than for bulk pellets in 6.1 above, which in most cases will still provide substantial savings when compared to heating oil. This would provide a commercial opportunity for retailers in road access communities to sell pellets.

It can also be seen from the following chart that transporting retail purchased pallets of 18kg bags as freight through NTCL will provide an economical alternative to heating oil in communities that are not accessible by road.

Estimated Cost of Palletized 18kg bags of Wood Pellets Compared to Heating Fuel
Retail Pellets Transported by Regular Freight

	Source Community	Retail Bag Cost of Pellets ($/18kg)	Equivalent Cost per Tonne	Equivalent Cost of Heating Oil ($/L)	Cost of Heating Oil ($/L) (May 2008)	Cost of Pellets as a % of Cost of Heating Fuel (May 2008)	Cost of Heating Oil ($/L) (May 2009)	Cost of Wood Pellets as a % of Cost of Heating Fuel (May 2009)
Pellets Available by Retail								
Hay River	NA	$6.00	$330	$0.45	$0.68	66%	$0.73	61%
Yellowknife	NA	$6.30	$347	$0.68	$1.22	55%	$0.79	85%
Whitehorse, Yukon	NA	$7.70	$424	$0.83	N/A	N/A	N/A	N/A
Pellets Trucked from Retail Stores								
Fort Providence	Hay River	$12.75	$701	$1.37	$1.39	98%	$0.94	145%
Fort Resolution	Hay River	$12.75	$701	$1.37	$1.35	101%	$0.90	152%
Fort Smith	Hay River	$12.75	$701	$1.37	$1.21	113%	$0.81	169%
Fort Simpson	Hay River	$14.27	$785	$1.53	$1.33	115%	$0.88	174%
Wrigley*	Hay River	$15.53	$854	$1.66	$1.49	112%	$1.20	139%
Fort McPherson	Whitehorse	$19.40	$1,067	$2.08	$1.27	164%	$1.10	189%
Tsiigehtchic*	Whitehorse	$19.40	$1,067	$2.08	$1.36	153%	$1.21	172%
Inuvik (Gas)	Whitehorse	$19.40	$1,067	$54.16	$18.77	289%	$20.60	263%
Pellets Shipped via NTCL from Retail Stores								
Lutsel K'e*	Hay River	$10.95	$602	$1.17	$1.08	109%	$1.29	91%
Sachs Harbour*	Hay River	$12.14	$668	$1.30	$1.28	102%	$1.38	94%
Paulatuk*	Hay River	$12.14	$668	$1.30	$1.26	103%	$1.38	94%
Ulukhaktok*	Hay River	$12.14	$668	$1.30	$1.19	109%	$1.38	94%

* PPD communities
The following exceptions to heating oil are highlighted in yellow above:
Hay River, Propane is sold by the litre, prices listed $ / L
Inuvik, Natural Gas sold by energy content (GJ), prices listed $ / GJ

7.0 Conclusions

Based on our research and analysis, the following items became clear:

1. Most of the wood pellets, including all of the bulk pellets, currently being used in the NWT are coming from La Crete Sawmills in La Crete AB; however there are also bagged pellets from several other mills in Alberta and BC being used in the NWT.

2. Bulk wood pellets represent a cheaper and less polluting heating source than fossil fuels in all communities with road access (with the exception of Norman Wells natural gas, which has an uncertain supply).

3. La Crete is the cheapest source of bulk wood pellets for the South Slave and North Slave regions due to the close proximity.

4. BC pellet producers may be able to provide bulk wood pellets to communities accessed via the Dempster Highway cheaper than from La Crete due to shorter trucking distances, however no bulk pellets are currently being transported to the NWT from BC mills.

5. Rail transport of bulk pellets into the NWT is not currently an option – It may be possible to negotiate with CN Rail to develop this service; however, they will likely not want to move a single grain car at a time.

6. Rail transport of bags of pellets as regular freight is possible, but although on the surface costs seem relatively cheap compared to trucking, logistical costs associated with loading and unloading and transportation to and from the rail depot tend to make trucking a cheaper and easier option.

7. Rail transport of bulk pellets from BC mills to Hay River could have a similar cost as truck transport of bulk pellets from La Crete, if CN agreed to provide this service, and proper handling facilities put in place.

8. Barge transport of bulk pellets in the NWT is not currently an option – as with CN above, it may be possible to negotiate with NTCL to develop this service; however, they will likely require a substantial quantity.

9. Barge transport of pellets as regular freight is possible, but costs are substantially higher than trucking bulk pellets for all communities accessible by road, both all-weather roads and winter roads.

10. As a back-up supply, bulk pellets are potentially available in central Alberta or BC. However, the additional cost of truck transport from either location will add at least $34 per tonne of pellets in Hay River, and $24 per tonne in Yellowknife. In both cases this is still cheaper than fossil fuels.

11. All-season road communities are the most favourable from strictly logistical and economic viewpoints.

12. Winter road communities have less favourable economics, and more logistical requirements, than all-weather road communities - but wood pellets are still cheaper than heating oil.

13. Bagged pellets can be purchased by the truckload and delivered to road access communities cheaper than the cost of heating oil. This represents a commercial opportunity for retailers for the residential market.

14. This simple dollars per unit of energy comparison analysis shows that wood pellets are cost competitive with heating oil. The analysis does not include the environmental benefits of wood pellets or the potential cost reductions from reduced heating oil spills. These additional benefits mean that wood pellets should be preferred over fossil fuels at similar economics, and are worth paying a premium for.

8.0 Recommendations

1. Investigate/pursue using wood pellets in all communities with road access to reduce costs and greenhouse gas emissions of space heating, particularly in bulk for commercial systems.

2. Investigate further the possibility of retailers in more road access communities selling bagged pellets for the residential market at a cost that is competitive with heating oil.

3. Publicize the economic and environmental benefits of wood pellets to encourage more business, institutions and individuals to move away from fossil fuels for space heating.

4. Increase efforts to publicize cost savings and greenhouse gas reductions of existing NWT wood pellet boiler systems, to build awareness and confidence in commercial wood pellet heating.

5. Investigate/negotiate with CN Rail the possibility of providing rail transport of bulk pellets in order to provide a cost-effective alternative source of bulk pellets.

6. Investigate/negotiate with NTCL the possibility of providing transport of bulk pellets, either by barge from Hay River or by ship from Richmond or Prince Rupert, in order to provide communities, particularly those without road access, with the greatest potential savings.

7. Further investigate the economics of shipping pellets from Quebec to the western Arctic communities.

APPENDIX 1

Heating Requirement and Wood Pellet Equivalent by NWT Community				
	Population	Heating Requirement (GJ)	Data source	Equivalent Tonnes of Pellets
All Weather Road Communities				
Behchok'o	2,016	120,000	est.	6,100
Dettah	223	13,000	est.	660
Enterprise	109	6,300	est.	320
Fort Liard	591	34,000	est.	1,700
Fort McPherson	791	46,000	est.	2,300
Fort Providence	802	46,000	est.	2,300
Fort Resolution	510	29,000	est.	1,500
Fort Simpson	1,264	170,000	est.	8,600
Fort Smith	2,430	320,000	est.	16,000
Hay River	3,954	530,000	est.	27,000
Inuvik	3,420	460,000	est.	23,000
Jean Marie River	71	3,245	PPD	160
Kakisa	55	3,200	est.	160
Tsiigehtchic	177	13,346	PPD	680
Wrigley	170	7,703	PPD	390
Yellowknife	19,155	3,993,600	YK CEP	202,720
Winter Road Resupply Communities				
Aklavik	629	36,000	est.	1,800
Colville Lake	151	3,397	PPD	170
Deline	538	36,036	PPD	1,830
Fort Good Hope	579	37,368	PPD	1,900
Gameti	307	12,503	PPD	630
Nahanni Butte	129	4,010	PPD	200
Norman Wells	948	130,000	est.	6,600
Trout Lake	85	3,651	PPD	190
Tuktoyaktuk	956	55,000	est.	2,800
Tulita	527	37,947	PPD	1,930
Wekweti	143	6,790	PPD	340
What'i	523	15,786	PPD	800
Summer Barge Only Resupply Communities				
Lutsel K'e	379	19,342	PPD	980
Paulatuk	324	23,081	PPD	1,170
Sachs Harbour	130	14,580	PPD	740
Ulukhaktok	406	35,909	PPD	1,820
Total	**42,492**	**6,300,000**		**320,000**