Feasibility Study for a Pellet Mill in the Lower Mainland of British Columbia

FRST 497: Grad Essay

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April 17th, 2015

Executive Summary

This report is to look at the possibility of establishing a pellet mill in the Lower Mainland of British Columbia. It will do an analysis on wood fibre supply and wood pellet demand, as well give an overview of market characteristics and operating prices, Later, the report will go over the strengths, weaknesses, opportunities, and threats a mill in the Lower Mainland would have.

There is great potential in the Lower Mainland to establish a pellet mill. There is a large source of quality fibre from numerous sources. The mill would have the unique chance to use urban wood waste as well as of local slash wood fibre as well as the traditional sawdust and chip fibre from local sawmills. The cost of sawdust and chip fibre in Vancouver is quite expensive due to the over competition from multiple users. Therefore, material costs maybe would be higher than an average mill.

In addition, the wood pellet industry is very competitive, and it is hard to be profitable when prices of fibre, transportation, and final sale are always changing. However, since transportation cost is the majority of the total cost of most pellet companies, a Vancouver mill would have a competitive advantage over other mills in Western Canada.

The demand for wood pellets globally is expected to double in all markets and become one the main drivers to reduce GHG emissions with the change of power plants co-firing with wood pellets. There is a question whether how sustainable shipping wood pellets across oceans can be, but hopefully Canada will develop a larger bioenergy market to reduce the reliance on European sales to make a profit. The goal of this product is to sell into any viable market but mainly Asia since being it is the closest international market except for the United States, it would have the lowest freighting costs associated with it.

With the current analysis, I believe the market is attractive and it would be a good idea to start a pellet mill in the Vancouver region.

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1.0 Introduction

The pelleting process is a fairly old process which started in the 1970's, where the wood fibre goes through a manually operated die and is extruded into a pellet. The process use to require large amount of labour but now with a lot of technological advances the process is now fully automated and requires little amount of labour.

Pellets can be made with any biological material that contains carbon. Wood pellets are made from wood fibre that is normally waste material from secondary manufacturing processes like sawmilling. However, any source of wood can be used. Hence, tree branches, stumps, and bark can be used in the wood pelleting process (Austin). However, most pellet producers are fed with sawdust, shavings or lower value logs rather than branches and stumps since it is cheaper to acquire constant and reliable wood fibre from sawmills and log sales.

Pellet manufacturing can be quite cyclical, depending on the fibre's origin. If the source of fibre are from sawmills that have fluctuating seasonal production, then wood fibre will also fluctuate. This can have major impacts on cash flows and operation logistics to try to maintain max production.

Wood pellets can be used in heating furnaces or stoves but also for industrial uses as in power generation through cogeneration of coal power plants. Since wood pellets provide a high energy output when burned and significantly lower greenhouse gas (GHG) emissions, it makes wood pellets very favourable for energy generation (Melin, 2012). Due to current international policies and incentives to reduce GHG emissions, wood pellets markets have multiplied greatly in the last decade.

Property	Unit	ENplus-A1	ENplus-A2	EN-B	Testing standard
Diameter	mm	6 or 8			EN 16127
Length	mm	3.15 ≤ L ≤ 40 [3)]			EN 16127
Moisture Content	w-% [1)]	≤ 10			EN 14774-1
Ash Content	w-% [2)]	≤ 0.7	≤ 1.5	≤ 3.0	EN 14775 (550 °C)
Mechanical Durability	w-% [1)]	≥ 97,5 [4)]		≥ 96.5 [4)]	EN 15210-1
Fines (< 3.15 mm)	w-% [1)]	<1			EN 15210-1
Net Calorific Value	MJ/kg [1)]	16,5≤Q≤19	16,3≤Q≤19	16,0≤Q≤19	EN 14918
Bulk Density	kg/m^3	≥ 600			EN 15103
Nitrogen Content	w-% [2)]	≤ 0.3	≤ 0.5	≤ 1.0	EN 15104
Sulfur Content	w-% [2)]	≤ 0.03		≤ 0.04	EN 15289
Chlorine Content	w-% [2)]	≤ 0.02		≤ 0.03	EN 15289
Ash Melting Mehaviour [4)]	°C	≥ 1200	≥ 1100		EN 15370

1) As received 2) Dry basis 3) A maximum of 1 w-% of the pellets may be longer than 40 mm, no pellets > 45 mm allowed
4) Deformation temperature, sample preparation at 815 °C

Figure 1: Threshold values of the most important pellet parameters (European Pellet Council, 2013).

ENplus-A1	ENplus-A2	EN-B
1.1.3 Stem wood 1.2.1 Chemically untreated residues from the wood processing industry	1.1.1 Whole trees without roots 1.1.3 Stem wood 1.1.4 Logging residues 1.1.6 Bark 1.2.1 Chemically untreated by-products and residues from the wood processing industry	1.1 Forest, plantation and other virgin wood 1.2 Chemically untreated by-products and residues from the wood processing industry 1.3.1 Chemically untreated used wood [a)]

a) Demolition wood is excluded. Demolition wood is used wood coming from the demolition of buildings or civil engineering installations.

Figure 2: Wood types that are permitted to be used for wood pellet production (European Pellet Council, 2013).

Furthemore, pellets standards have increased and now the wood has to be dried, and measured for different characteristics if it is to be sold into specific international markets. Moisture and ash content, bulk density, amount of fines, and other chemical contents can be measure so that pellets can meet certain market certifications (Figure 1) (European Pellet Council, 2013). In general, the European standard ENplus is thought to be the most stringent standard and is most likely accepted in most international countries. The standard includes quality classes A1 and A2 as well as a B class. Class A1 is the premium quality class that is normally used in private household boilers or stoves since A1 pellets produce the least amount of ash and fulfill the highest requirements. Class A2 is used in larger installations where more ash is produced. The EN B class is for the industrial market and is the least stringent from all the classes. In addition, only some sources of wood are allowed to meet certain standards like the European standard ENplus (Figure 2). Only whole untreated wood is used for the ENplus A1 class, but branches and stems may be used for the A2 or B classes.

This study is intended to weigh the opportunities and threats of establishing a pellet mill in the Lower Mainland of Vancouver, British Columbia, and determine whether it could be a beneficial and profitable business. There is a detailed analysis of fibre supply, pellet demand, the manufacturing process, markets and prices, and finally, industry competition to aid in making a general decision.

2.0 Boundary and Scope

The main scope of this study is within the Lower Mainland of British Columbia. However, a greater outlook of international markets and logistics was done to compare and assess what conditions for a mill in Vancouver would have. There are limitations in the analysis due to fact that there is limited data on current conditions in the Lower Mainland.

3.0 Manufacturing Process

There are 7 main steps in the wood pellet manufacturing process. These steps are fibre collection, hammermilling, rotary drying, pelletizing, cooling, screening, and packaging. Each step is critical for preparing quality pellets. However, fibre collection is the limiting factor for the entire process. Each step is described in detail below.

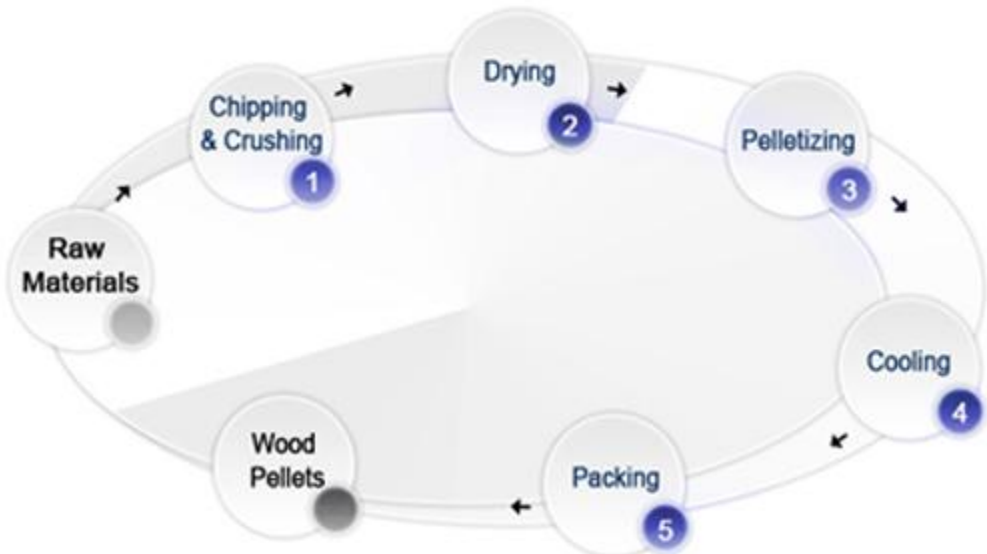

Figure 3: General Wood Pellet Manufacturing Steps (Amisy Group)

3.1 Fibre Collection

Wood fibre is collected and brought to the mill as “green” fibre, meaning a moisture content greater than 10%, or have been previously dried by another company. Usually, sawdust and shavings have been the main fibre sources. However, bark and other fibre from branches and stumps are other viable options for creating wood pellets. The fibre is normally stored at this stage so that production can be managed continuously. It is at the upmost importance to keep the fibre clean so that there are no unnecessary maintenance repairs or downtime. The amount of fibre and the type of fibre source determines the capacity of the mill. Therefore, this stage affects every step that follows (Murray, 2010).

3.2 Hammermilling

The wood fibre like sawdust and shavings go through a hammermill so that the wood fibres are a small uniform shape. Larger fibres, like branches, have to be chipped before entering the hammermill. After, the fibre is screened for large fibres that will clog the pellet mill as well as rocks and metals that could damage the mill. This stage can before or after the drying stage (Murray, 2010).

3.3 Rotary Drying

The fibre gets dried in a rotary drier so that the moisture content is roughly 10%. The moisture content of the pellets will be below 10% after the full process of manufacturing. The moisture content of wood pellets have to be below 10% to meet industrial standards since wood pellet generate more energy efficient as moisture level decreases. This stage requires a large amount of energy. Pellets come out with a net positive energy product. However, this process is roughly 70% amount of energy for the entire process. Thus, it is important to manage this stage energy use (Murray, 2010).

3.4 Pelletizing

After drying, the fibres get compressed into pellets. The pressure and the heat provided by friction and steam, softens the lignin and the fibre so that the fibre is formed into the shape of the pellet. There are many sizes of pellet mills. The size of the mill should be determined to the max capacity of the source of fibre coming in so that production can stay continuously all year round (Murray, 2010).

3.5 Cooling

Once the pellets come out of the pelletizer, the pellets are hot and soft. They need to be gradually cooled so that strength and durability is maintained. This process does not require any energy, but is as important as the other processes (Murray, 2010).

3.6 Screening

The wood pellets after they have been cooled have to be screened for dust and fines, larger fibres that passed through the pellet mill unchanged. Fines are moved back into the pelleting process to be grinded and pelletized again. Removing dust and fines allows the packaging process to be as clean as possible to ensure quality of the final product (Murray, 2010).

3.7 Packaging

There cannot be any excess moisture or heat in the packaging process or there is a risk of the pellets rotting. Pellets should be tested to meet industrial standards. After the pellets are packaged, they are usually ship to a port and shipped overseas to buyers in other countries where they are brought to heat homes or used for power generation. They can also be sold directly to local retailers or directly to the consumers such as residential or industrial users (Sénéchal & Grassi, 2009).

4.0 Supply Chain

The supply chain for wood pellets can be described with following steps; raw materials, suppliers, manufacturing, distribution, customers, and consumers. Each step of the supply chain is critical for the production of wood pellets. Each step has their own constraints and risks involved which will be described below.

4.1 Raw Materials

Wood fibres are collected at sawmills and other secondary manufacturers. Chips, shavings, and sawdust which are usually collected into bins which get picked up by waste companies or biomass distributors. Wood fibres can also be collected through arborist companies in Vancouver where branches, stumps and other biomass material can be dropped off or picked up. Raw materials account for a high cost for wood pellet manufacturers (The Associated Press, 2008). However, any kind of wood is useable even though each type of wood, hardwood or softwood, has different traits related to ash content or density (Räisänen & Athanassiadis, 2013). Therefore, it is best to buy the cheapest supply of wood fibre you can find. In addition, bark is becoming even more common as stock feed for pellet mills. Even though it has higher ash contents than white wood, which lowers pellet quality, there is so much demand there has become a market for lower quality wood pellets with bark to generate power. This is most common when bark is high abundance and there is no better use for it (Melin, 2008).

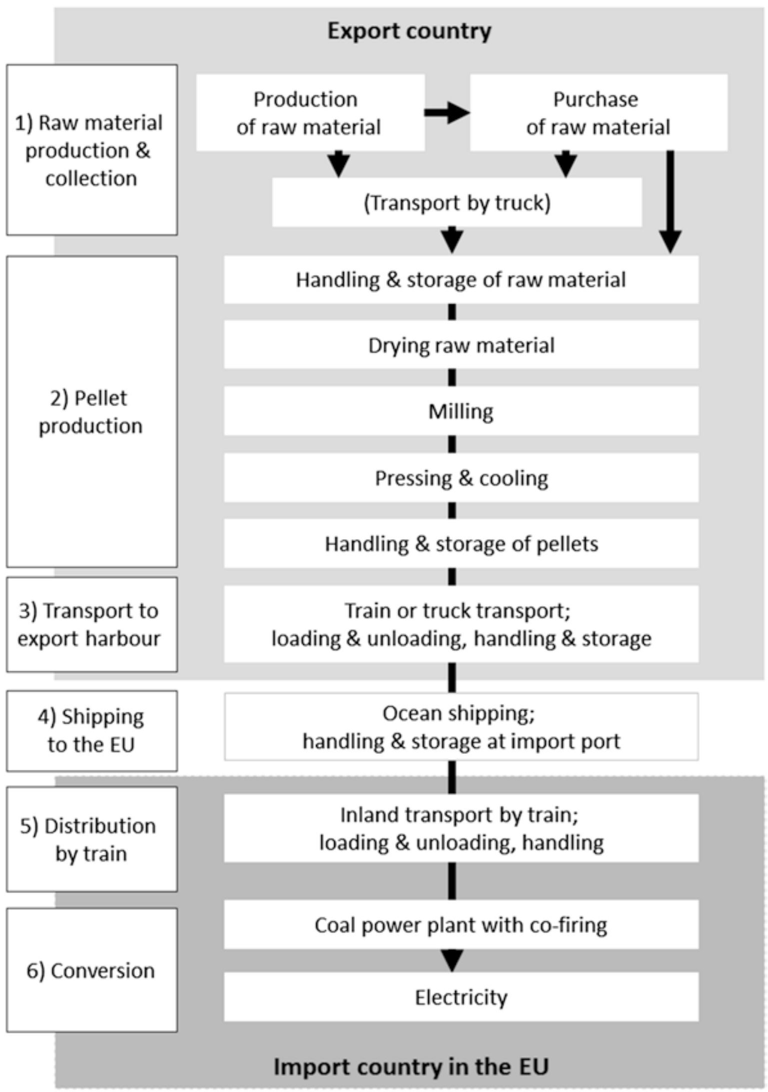

Figure 4: Outline of Supply Chain for Wood Pellets (Ehrig, 2014)

4.2 Suppliers

Fibre can be directly supplied from sawmills by truck for shorter distances and by freight for longer distances. Usually pellet mill are tied to sawmills and have pretty secure lines of constant supply that is local. As for arborist companies, there supply would be less predictable being more seasonal. However, the amount of a fibre for arborist companies could be adequate and would be a more local source of fibre.

4.3 Manufacturing

For manufacturing, there are different sizes of dies that produce different output of pellets. It is good to note for every 2 tons of “green” wood fibre”, 1 ton of pellets can be made on average (Vecoplan). There it is good to know that maximum supply coming in so that the right size pellet mill can be established. The manufacturing steps were described before, but it is good to note that mills try to run at max capacity, 24 hours a day, all year long to create economies of scale. Therefore, it is important to reduce machine downtime by having spare parts and specialized mechanics.

4.4 Distribution

Pellets can be bagged into smaller 40-50lbs bags that are shipped on pallets or can be distributed in bulk or large 1 ton bags. The smaller bags are normally for small consumers that usually use pellets to heat their homes, and the large bags or bulks are used industrially to generate electricity. The pellets can be shipped locally by truck to retailers or local consumers directly. However, most commonly pellets are exported overseas where they first get transported to a port of export and then shipped to wholesale markets overseas. The usually distance from the pellet mill to a port is 220km (Sénéchal & Grassi, 2009). There have been major setbacks in deliveries due to port inadequacies. This has cause major improvements in pellet storage and pellet logistic in major ports (Sénéchal & Grassi, 2009).

4.5 Customers/Consumers

There are many customers or consumers for wood pellets. Pellets can be sold in residential markets for animal bedding or pellet stoves. They can also be sold to other wholesalers of pellets in Canada or in other countries or sold directly to industrial power generation market directly. The industrial market usually has long term supply contracts of 3-5 years where large quantities of high quality wood pellets are shipped to meet monthly demands (RISI, 2014; Steiner, et al., 2011).

5.0 Wood Fibre Supply Analysis

From a BC Hydro study in 2002, there was estimated that there is about 1.6 million dry tones of wood fibre that is burned for no value on the mainland of British Columbia. This shows that there is plenty of fibre that is ready to be used for other uses in all of BC However, in a more recent study for just the coast there is estimated that there is almost 12million m^3 of wood fibre that could be used for biomass energy uses (BC Hydro, 2013). This is broke down to 3million as hog fuel or tops and branches and the remaining 9million as unutilized standing timber that is available in the Annual Allowable Cut on the Coast of BC. However, this is for the whole Coast of BC and includes from Vancouver to Prince Rupert. Therefore, it is hard to assume the current fibre supply around the Lower Mainland.

Yet, there are 295 secondary manufacturers of wood products in Vancouver and the Fraser Valley which is about 50% of all manufactures in BC (Macdonald, 2014). In 2011, there was 5,094,000m3 of wood consumed by all of BC secondary manufacturers (PricewatercoopersCoopers LLP, 2013). Therefore, these 295 mills, on a 50% basis, would consume 2,547,00m3. However, in another report in 2013, the coast manufacturers consumed 1,360,000m3 of wood fibre (G.W. Tree Inc., 2013). Taking an average between these numbers, 1,867,00m3, should give a fairly reasonable usage of wood for Lower Mainland mills. Therefore, with a lumber recovery factor of 232fbm/m3 or 54.7% gives 1,021,000m3 of waste wood fibre usable annually for pelletization or 85,100m3 per month (PricewatercoopersCoopers LLP, 2013).

The loose bulk density of Sitka spruce chips can range from 206kg/m3 to 320kg/m3 as moisture content increases (Kofman, 2010). Using a the midpoint of 263kg/m3 and assuming all species are relatively equal shows that roughly 22,381tons of wood fibre every month is created. All this fibre would create roughly 11,190 tons of wood pellets assuming the moisture content would be 50% of total weight. Depending on the location of these secondary manufacturers, not all this fibre would be accessible. Even more, this fibre is usually burned for electricity or bought and then sold to farmers, landscape companies, or sold cross borders to the United States (Biomass, 2014). Therefore, if assumed that 50% of all fibre would be available to be used, this would leave 5,595 tons of pellets a month, roughly 67,000 tons of pellets annually.

There is no data on the available wood biomass from arboricultural companies which makes it hard to analyze this fibre supply. However, there have been initiatives from local municipalities to improve the green spaces of Vancouver. There will be roughly 25,000 trees planted every year till year 2020. This means that there will be a greater supply of urban wood waste from these trees than before. Furthermore, the use of this fibre would limit the production tof industrial wood pellets, meaning that this fibre is of less quality to create high quality pellets for the residential heating market.

5.1 Bargaining Power of Suppliers

Currently, fibre costs generally are low for most mills, and companies can acquire wood fibre quite easily. Since a lot of the pellet mills are tied sawmills, they usually have a secure source of fibre. Furthermore, with the mountain pine beetle epidemic, there is a lot excess low quality wood that is good for pelletization, which keeps fibre costs low at the moment for interior manufacturers. However, the supply of beetle dead wood will not sustain every interior mill. Therefore, in the future, interior mills will have more competition over fibre.

On the other hand, sawdust prices in the Lower Mainland of BC have continued to rise over the years (The Associated Press, 2008). Since, sawdust is used in landscaping and farming, there is more competition for sawdust and wood fibre in urban settings. In past news articles, farmers complained that a truck of sawdust is now $1200 from $600 within a year (The Associated Press, 2008).

If fibre costs continue to rise, companies will have to pay the prices set by suppliers since there are only of few suppliers for each mill. Therefore, suppliers have a high power over pellet mills. This could potential squeeze out some competition as small mills will not be able to afford the new prices, but on the other hand, be a major factor in the cost of producing pellets in the Lower Mainland.

6.0 Pellet Demand Analysis

Environmentally, wood pellets have been acclaimed as a sustainable choice. However, there has been skepticism about how better environmentally wood pellets are compared to coal. Since pellets are shipped on huge freighters all around the world, there might be a high carbon footprint just in the transportation of the product which could offset the emission reduction (Nunez, 2014).

Still the main market driver for wood pellets is the environmental targets in reducing GHG emissions and increasing the amount of electricity generated by biomass and renewable sources (Lamb, Daim, & Leavengood, 2012). This has created a great surge in demand all around the world. The European Union is the largest market today and is the main market driver. However, other markets and continually opening up and new demands in Southeast Asia and Latin America have become also dominant markets.

The major importers of Canadian wood pellets are the United Kingdom, accounting to more than 50% of all exports. The United States, Italy, South Korea and Japan are the next largest importers of Canadian wood pellets. These four countries account for 44% of total production in Canada and 96% of all Canadian exports (Stats

Canada, 2015). There has been a steady climb of the amount of wood pellets being exported since environmental movements about greenhouse gases in 2007. However, the increases in exports have stalled which could mean that supply has reach demand or Canadian wood pellets are too expensive for the European markets compared to other manufacturers like in Southeast United States.

Rank	Country	2014		2013		2012	
		Quantity,KGM	Value,CAN$	Quantity,KGM	Value,CAN$	Quantity,KGM	Value,CAN$
Total	World	1,637,392,857	275,987,791	1,640,231,208	260,078,002	1,369,176,738	208,246,672
1	U.K.	982,809,144	149,760,584	1,026,526,570	149,707,952	794,379,153	116,859,288
3	Italy	204,528,467	38,559,233	219,551,041	40,105,839	85,237,666	14,308,893
4	S. Korea	150,003,940	22,443,229	113,077,437	18,053,724	2,083,648	458,753
5	Japan	61,807,302	11,197,791	76,018,205	12,481,791	105,640,409	15,707,588
6	Denmark	17,197,480	2,559,589	13,635,376	1,930,958	11,464,200	1,963,975
7	Singapore	705,037	202,445	747,258	205,197	589,080	164,592
8	Taiwan	273,511	83,096	229,766	76,981	200,676	62,061
9	U.A.E	228,934	69,825	0	0	0	0
10	Brazil	360,000	57,600	0	0	0	0

Figure 5: Top 10 countries for exported Wood pellets from Canada (Stats Canada, 2015)

Despite the fact that the economies of many European countries have suffered a lot even after the financial crisis, the economy of UK has performed much better. In the next 5 years, the Europe and Asian markets for wood pellets are expected to double as carbon emissions and greenhouse gases become a greater global problem (RISI, 2014). The Asian markets in Japan and South Korea have proven to be big importers of Canadian pellets. However, there are major risks when importing large volumes of wood pellets. Therefore, it is hard to secure large contracts and thus export volumes from Canada are not stable.

6.1 Bargaining Power of Buyers

Wood pellets are a commodity product and therefore, its price is tied to current markets trends of demand a supply. Currently a few big players in the European market sets the price of wood pellets globally (Steiner, et al., 2011). However, there are many mills under construction and it is expected that supply should surpass demand (RISI, 2014). This could lead to a decrease in prices which would grant buyers a little more power since they might have the ability to source their wood pellets from many other places competing for sales.

6.2 Threat of Substitute Products

Currently, there is not much threat for substitute pellet products. Since wood pellets are the most efficient pellet in the market, other pellets from straw or husks are not as valuable. However, there have been major developments in South Asia with husk, bamboo, or straw pellets, which would compete in Asian markets in the future (Lamers, Junginger, Hamelinck, & Faaij, 2012). However, these mills tend to be small and maybe not be a reliable source of pellets for industrial purposes.

Furthermore, if biofuels and other bioenergy uses of wood fibre become more feasible or efficient, there will be more substitutes for wood pellets in power generation and even more competition for wood fibre. However, these technologies require a lot more capital than wood products and the transport of such fuels have not been tested and may not be feasible to ship cross continents. Yet, these biofuels can be more efficient than wood pellets in heat and power generation and great interest has been set in research to further examine these potential substitutes. Furthermore, other renewable energy like wind, hydro, and solar are also other substitutes for the generation of power from wood pellets. All these substitutes could be a major threat to the demand of wood pellets in the future as more countries try to diversify their energy sources. Nevertheless, wood biomass and pellets are proven to be a good energy source compare to other power generation (Melin, Development of the Canadian Bulk Pellet Market, 2012). All these factors make it difficult to truly estimate the demand of wood pellets in the future.

Locally, sawdust and chip fibre is normally used or sold as hog fuel for local power generation. This is one of the most competitive substitutes for pellets in the Lower Mainland. Since it can be quite expensive to transport and then convert wood fibre into pellets, it makes it less attractive to do in a small scale. However, if fibre is still available for a reasonable price a pellet mill can be quite viable since the main market would be overseas and not to local power generation companies. Furthermore, it could be possible that pellets could be easier to transport and then maybe cheaper than direct hog fuel transport. This could make the demand for wood pellets locally dramatically higher. However, further analysis would have to be done to confirm that theory.

6.3 Political/Legal Factors

The European Union (EU) 2020 policy targets for Renewable Energy Sources (RES) and GHG emission reduction has played a huge role on the demand for wood pellets, requiring imports from North America to fill demand in the industrial pellet market. However, climate targets in Europe might be changing and current policies are always changing making the EU demand very unpredictable. This could lead European pellet buyers to stop buying North American pellets and affect the industry in North America terribly (Steiner, et al., 2011).

Also, the Asian market is also looking to reduce the reliance of fossil fuels for energy and thus, looking to develop more renewable energy sources. This means that countries like South Korea and Japan may become big importers of pellets. Wood pellet imports from North America have increased every year since the early 2000's (Lamers, Junginger, Hamelinck, & Faaij, 2012). However, current Asian pellet markets are not guaranteed and current market trends and policy factors in Asia make it hard for wood pellet companies to sell in these countries. Furthermore, if political incentives become available in Russia to produce pellets, Russia could be the main supplier for both Asia and Europe and out-compete North America companies (Lamers, Junginger, Hamelinck, & Faaij, 2012). Yet, this might not be feasible due to Russia's poor infrastructure to maintain reliable transport.

The North American market for wood pellets could rise in the future. From the international targets, it is expected that if Canada and United States tries to reduce their GHG emission the demand for wood pellets will rise for co-firing projects. In addition, if policies for carbon emissions become more restrictive and drive fossil prices up, wood pellets will become more economical for power production or heating (Pa, Bi, & Sokhansanj, 2011).

6.4 Socio-cultural Factors

Unlike fossil fuels, biomass fuels like pellets can be ecologically sustainable and it is recycling a waste product that would otherwise have to be disposed of. Since the world is becoming more cautious about the environment, especially GHG from fossil fuels, many countries have implemented regulations to reduce greenhouse gas emissions in which works in favor of biomass producing companies (Lamers, Junginger, Hamelinck, & Faaij, 2012). However, there has been skepticism in the news and some environmental journals about the legitimately of how environmentally friendly shipping large volumes of pellets overseas is (Nunez, 2014). However, there is low risk that any consumer opinions will affect policy and demand of pellet sales.

6.5 Technological Factors

Wood pellet technology is now pretty advance and mostly automated, making the need for manual labour low. There have been increasing standards and measuring methods of these standards so that wood pellets can have a certified quality and performance. However, the outlook for advances in wood pellet technology is low. There is research on the use of torrefied wood pellets which produce a higher output of energy than normal wood pellets (Melin, Design of Logistics for Regular and Torrefied Pellets, 2012).

Yet, there are increasingly more research advancements with use and performance of using wood pellets for power generation and of industrial heating uses for residential properties. This research is to improve the GHG capturing in industrial firing projects as well as improving efficiency in heating communities and homes with biomasses (Pa, Bi, & Sokhansanj, 2011). If these become proved to be valuable this could increase the demand for wood pellets in North America greatly.

In addition, there are increasingly more new technologies being researched and tried in biofuels and other uses for wood fibre. If these new technologies become more profitable, feasible and reliable they could be a huge influence on the wood pellet industry by competing for sources of fibre.

7.0 Pellet Market Analysis

Wood pellets are made in almost every continent. The major players in pellet production are Canada, U.S.A., Russia, and many European countries mainly in Eastern Europe (Steiner, et al., 2011). However, there are countries that are not big players or could be bigger players in the wood pellet industry since of political or financial reasons. Countries like Australia and Russia have a lot of forested lands, but do not have the resources available to capitalize and compete with other countries. Other countries in Eastern Europe or Southeast Asia are starting up biomass pellet mills which will supply both Asian and European markets (Steiner, et al., 2011).

Currently, Canada produces roughly 3.2 million tons of pellets every year while the U.S.A produces 4.5 million (Murray, 2014). Currently, BC accounts for 65% of Canada's production and 35% are accounted for the rest of Canada. Pellets mill range in size which has a correlation to how large the supplying source of fibre is. In Canada, plants can range from a low capacity, less than 30,000 tons a year, to up to 400,000 tons per year. However, the average mill in BC is 150,000 tons a year while the average plant in the east coast is 50,000 tons per year (Wood Pellet Association of Canada).

Pellets are shipped all around the world, and there have been the establishment of many major routes. Currently, since freighting and sales prices are volatile, the movement of pellets can be anywhere around the world. The figure below shows the major routes within the world. The main obstacles of transport are generally port inefficiency to store pellets and the reliability of supply from pellet producers, and also play a factor in the timing of shipments and overall efficiency (Sénéchal & Grassi, 2009).

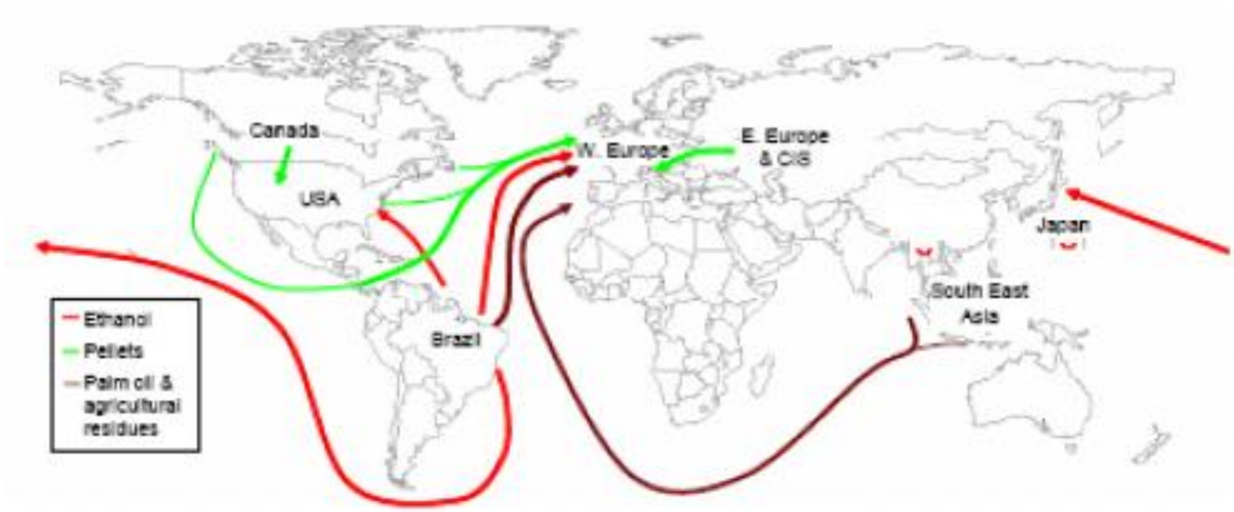

Figure 6: Major pellet trade routes in the world (Sénéchal & Grassi, 2009)

8.0 Price Analysis

It has been determined that it is best to have a pellet plant at 10-12ton/hour production to gain economies of scale. Furthermore, it is expected to cost 1.2 million dollars for every 1ton/hour production (Murray, 2010). The total cost would roughly be 12-14.5 million dollars. This would cover all costs, insurance and contingency. Definitely a more detailed cost analysis will be done before any mill would be constructed. However, this gives us realistic costs to set up a mill.

Since wood pellets are a commodity product and prices are set by the markets, most pellet companies try maximizing their economies of scale to be more profitable. There are many different indices that keep tract of pellet prices. One thing that is common between market indices is that pellet prices keep on fluctuating. However, prices are currently around $160/ton of industrial pellets which is forecasted to stay steady in near future (Argus, 2014). In addition, current freighting costs are always changing and could cost between $25-$50/ton to ship pellets to Europe (Lamers, Junginger, Hamelinck, & Faaij, 2012). These fluctuating prices might make it hard for small North American producers to make steady profits in this every changing environment. Below is a breakdown of average operating costs for pellet mills in different countries exporting to the European Union (EU). It is shown that freighting and transportation costs can be roughly 50% of all costs, and secondly, raw materials can roughly cost 33%.

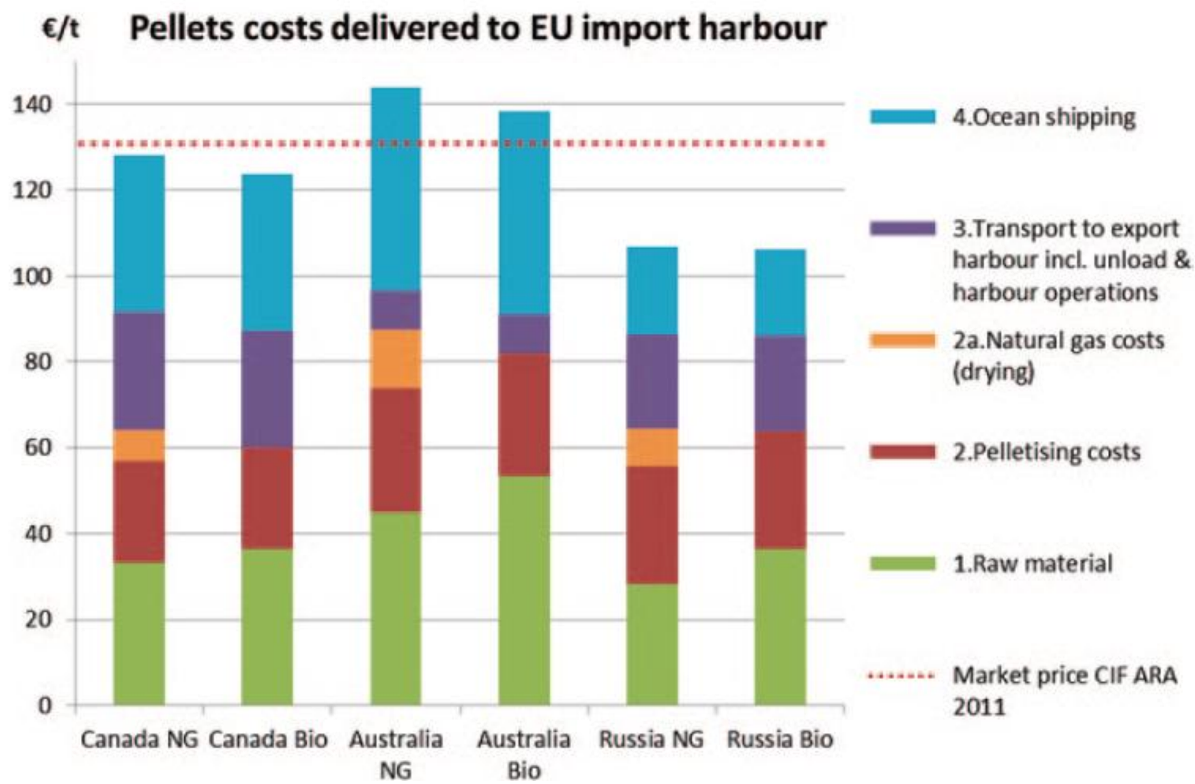

Figure 7: Operation costs for pellet mill in different countries (Ehrig, 2014)

9.0 Competition Analysis

As said before, it requires a lot of capital to start up a wood pellet mill. Yet there are many mills under construction and proposed in North America. In 2012, there were 13 proposed mills and 4 mills under construction (Wood Pellet Association of Canada). This will create even more competition among pellet mills in North America. However, maintaining large contracts are hard for small producers and thus maybe not compete against large producers (RISI, 2014).

Another barrier of entry would be finding a secure fibre supply. There are a lot of mills operating with long term wood fibre suppliers. It is said that fibre is hard to secure and is becoming expensive (The Vancouver Sun, 2008). Therefore, new mills might not run at max capacity. This business runs on economies of scale, so if there is not a high supply of fibre, then business might not be profitable in the short or long term.

9.1 Intensity of Rivalry among Competitors

Mostly, wood pellets companies sell high volumes under long term contracts, and since there is so much demand in Europe, there is not much competition between competitors. Currently, small producers sell their pellets to large mills so the larger mill can secure big contracts (Hardman & Co., 2011). However, as supply is expected to surpass demand in the next couple of years, and prices drop, companies will have to compete to stay profitable. It all depends on the future demand of the product expectations of doubling stay the same.

9.2 Competitor Key Success Factors

Some key success factors of most pellet companies have are having a secure fibre supply, high volume production that can be maintain all year round, long term sale contracts to many customers to provide sale security in the future. Also, companies need have to a good financing as well the ability to retain employees (Viridis Energy Inc., 2014).

10.0 Discussion

10.1 Strengths

The major strength a mill in the Lower Mainland will have is that it will be close to a port of export. Since it is on the coast, it has a good advantage to sell to Asian markets. Plus, since there are no mills on the coast or on Vancouver Island, a mill in Vancouver would have advantage over interior mills. A mill in Vancouver would be able to create more sustainable wood pellets for the Asian markets, compared to other mills in North America. There are mills in the northern interior that are close to the Port of Prince Rupert, but the transport to port is further than in a mill in Vancouver. Both Vancouver ports and Prince Rupert ports have increased their capabilities to handle large volumes of wood pellets for export, making distribution easier during set up (Sénéchal & Grassi, 2009).

In addition, there are many sources of fibre in the Lower Mainland, described earlier in this report. There are sawmills located all across the Lower Mainland. If fibre can be secured from these sawmills, the mill can have steady production. Also, other arborist companies have other sources of fibre useable for production. Other wood waste from construction and etc. could potential be used. However, wood waste that has been treated must not be used and more efforts will be needed to control quality of wood fibre in this case. Lastly, forest companies around the lower mainland, could potential transport and sell their slash to the pellet mill.

10.2 Threats

Yet there are some weaknesses for a mill located in Vancouver. First of all, a secure source of fibre is not guaranteed. There is a lot of competition for sawdust fibre from farms, landscape companies and other biomass distributors. As wells, prices of local fibre could be more expensive than the interior sources of other mills (The Associated Press, 2008).

Price of land or renting facilities is super expensive in Vancouver and the Lower Mainland, so finding the perfect location might be difficult. There might be more regulations that control the production of wood pellets in area close to residential communities. Furthermore, the capacity of a mill in Vancouver has not been determined, and thus, maybe there will not be enough production possible to cover costs within Vancouver.

10.3 Opportunities

There could possible expansion to other locations on Vancouver Island or further into the Fraser Valley. There are also expanding markets and new markets emerging which help the sales of a new mill. Canada and the United States are continually trying to reduce GHG emissions and looking into potentially using wood pellets for co-firing projects and other energy projects. This could be a potential for a additional sales locally in North America.

There are opportunities to sell pellets to other larger producers that try to secure larger contracts. This opportunity could create easy sales since it is hard to secure contract to industrial consumers since they need very large volumes on a regular basis. However, definitely the sale price needs to be considered before consider action of this kind.

There is increased proposal to create large projects that would use biomass to generate heat for entire communities as well as power generation. Co-firing of wood pellets in coal power plants have been proven to be a optimal solution in reducing GHG emissions. This could be new opportunities to have large contracts in Vancouver and across Canada (Pa, Bi, & Sokhansanj, 2011). Currently there is a UBC gasification plant that is supplied from a bulk biomass company in Cloverdale. There could be an opportunity to create pellets for higher quality output for this gasification plant.

There are also opportunities to use other feedstock like grass and agricultural waste to make pellets. This would hopefully create a more sustainable renewable energy industry by creating higher quality of locally sourced biofuels. This mill could be a industry leader in the use and creation of new sources of pellets.

10.4 Threats

Other countries like Russia or Australia could become huge producers of wood pellets and compete with the North American wood pellet industry. Also increased production in Europe and Southeast Asia could potentially supply their own demand. There are a number of pellet mills under construction in North America, and there are even more proposed. This could generate huge rivalry within North America.

Furthermore, policy around the world is not guaranteed to stay the same, and new policies take a long time to be created and implemented. Countries, also, seem not fully committed to reduce GHG emissions. Therefore, there is skepticism whether demand for wood pellets will continue to double in the next decade or not. Other forms of biofuels and renewable energy are being researched and implemented and could potentially take over the industry.

Most companies face high transportation, high financing, and fibre costs. Transportation is usually 50% of the total cost of producing wood pellets, where about 25% is ocean shipping and 25% is transportation of delivering raw materials. However, in the Vancouver mill raw material delivery would be considerably less. Raw materials are about 33% of totals costs, so all together these two things can be up to 80% of total costs (Ehrig, 2014).

11.0 Conclusion

Overall, the outlook for the wood pellet industry is quite favorable amongst the highly competitive market. Buyer and sellers will have the most power over pellet producers, and there is expected to be high competition in the future as new mill are being built all over the world as well there is the threat of emerging bio-technologies. The manufacturing process is quite simple, and the technology is at its maturity with the advancement of torrefied pellets

The demand for wood pellets in all export markets for North America is growing and is expected to continually double. In the short term, supply outpaces demand, and new and current pellet mills might have trouble selling for a profit. Current policies and goals for GHG emissions are not fully accepted but yet still is the main driver for wood pellet exports as countries try to reduce their carbon footprint.

In the long term, other countries like Russia, Australia, and countries is South America will continue to grow their own wood pellet industry as they continue to build infrastructure and gain investments. Therefore, there will be more competition in the EU and Asian markets, and the best direction would to sell and grow the bioenergy industry in North America. Yet there is the risk of other technologies taking over the bioenergy business, but for now, this risk is small and expected to remain small for quite some time.

In conclusion, since Metro Vancouver is a main port for exports, it makes transportation costs lower. Since there is so much fibre flowing through Vancouver and there is a close exporting port, on the surface, it looks like a great place to start a wood pellet plant. Demand is expected to double in most markets and at least stay steady. However, there needs to be a further study in the specific costs for starting a pellet mill in the Lower Mainland to be certain if a mill could be profitable. Overall, I believe a pellet mill in the Lower Mainland of BC is feasible.

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