CASE STUDY

Green Energy
as a Rural Economic Development Tool Project

COMMUNITY: District of Lillooet

PROJECT: Biomass Heating System

NOTES:

LiLLOOET
GUARANTEED RUGGED

FUNDED BY:

British Columbia – Ministry of Jobs, Tourism and Innovation – Pine Beetle Epidemic Response Branch

Southern Interior Beetle Action Coalition – SIBAC

Canada's Rural Partnership – Government of Canada / Gouvernement du Canada

Columbia Basin Trust – a legacy for the people

Cariboo Chilcotin Beetle Action Coalition

Omineca Beetle Action Coalition

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Executive Summary

The Lillooet Community Biomass Energy Project (BEP) was a $705,000 capital investment to install a new pellet boiler and upgrade the Lillooet Recreation Centre (REC) heating system. The project involved replacing one of the older used propane boilers with a new 400 kW KOB pellet boiler. The new boiler supplies 80-85% of the heat demand for the entire REC. The project also saw upgrades done to the building heating system and the joining of the two separate heating systems. The pellet boiler is housed in a standalone container outside the building. There is also a 45 tonne pellet storage silo.

In 2007 the District of Lillooet (DoL) was approached about switching the heating from propane to biomass. A proof of concept study was completed by Mr. Cornelius Suchy of Canadian Biomass Energy Research (formerly Mawera Canada). Based on this study the DoL decided to seek funding in support of the project. In late 2008 they were awarded a grant from the Gas Tax Innovation Fund program funded by the Government of Canada in partnership with the Province of BC and administered by the Union of BC Municipalities. 2009 saw DoL staff continuing to develop the project until early 2010 when a project manager was hired to oversee the development. Engineering was completed in the spring and summer of 2010. In August 2010 Fink Machinery of Enderby, BC was selected to supply a pellet boiler for the project. Environmental permitting was completed in the fall of 2010. Construction started in April 2011 (at the end of the 6 month pool season). Construction was completed in June 2011 with start-up beginning in September of the same year. After some initial troubleshooting the system went into full operation in March 2012.

The total cost of the project was $705,000 ($630,000 before taxes). $467,000 was received as a grant from the Gas Tax Innovation Fund program funded by the Government of Canada in partnership with the Province of BC and administered by the Union of BC Municipalities. The remaining $238,000 was from the DoL's REC Centre Reserve Fund and Surplus. The boiler system was $312,000, building upgrades were $207,000 and $111,000 for engineering and project management. Operating costs for the new system are $52,000/year. Operations cost include $31,000 for pellets, $11,000 for propane peaking fuel, $6,000 for maintenance, and $4,000 air stack testing. There has been no additional cost for staffing. Fuel costs for the old propane system were $78,000/year. The BEP has resulted in approximately $26,000 in annual savings for the DoL.

BEP YEARLY OPERATING COSTS	YEARLY COST
Pellets	$31,000
Propane	$11,000
Staffing	$0
Maintenance (over the life of the project)	$6,000
Testing	$4,000
Total BEP Yearly Costs	$52,000/year
Yearly Costs prior to BEP	$78,000/year
Saving Due to BEP	**$26,000/year**

Table 5 - Rate of Return

	Boiler System Only Actual	Entire BEP Actual
Total Project Capital Investment	$411,000	$705,000
DoL Investment	$140,000	$238,000
Savings	$26,000	$26,000
Simple Payback	5.4 Years	9.2 Years
Net present Value (15 years and 7%)	$96,806	$152,000
Internal Rate of Return	17%	7%

Introduction and Overview

The District of Lillooet (DoL) is a small community of approximately 2300 people and has a trading centre of 5000. Lillooet is located 2.5 hours west of Kamloops and 4 hours northeast of Vancouver.

Figure 1 - Map of BC

Traditionally Lillooet has been a resource driven community and in particular forestry and mining. The town is well developed for a community of its size and has 3 schools, hospital, and recreation facilities. Like many communities Lillooet has signed the Province of BC Climate Action Charter. As a signatory to the Charter, Lillooet has agreed "to measuring and reporting on their community's greenhouse gas emissions profile. They will also work to create compact, more energy efficient communities." (Province of BC).

Lillooet owns and operates a recreation centre providing a range of services. The facilities include:

- 25m Six Lane Swimming Pool with Hot Tub and Sauna
- Regulation size Ice Arena
- Gymnasium
- Meeting Rooms
- Fully Equipped Weight Room
- Library
- Day Care Centre
- Sports Field

Figure 2 - Lillooet Recreation Centre

The REC centre consists of two separate building. The buildings have separate foundations and abut one another. Each building has a separate heating system. The primary source of heat for the swimming pool and both buildings, prior to 2011, was propane. Lillooet is located on the BC Hydro electric grid but is not serviced by natural gas. The largest heat demand is for heating of the swimming pool during the 6 month operating season of November to April.

In 2011 the DoL upgraded the heating system for the swimming pool and both buildings. The Community Biomass Energy Project (BEP) consisted of two major parts. The first was to install a biomass boiler to generate the majority of the required heat demand. The second was to upgrade and connect the separate heating systems from each building.

http://www.lillooetbc.com/Business/Invest-in-Lillooet.aspx

From Project Concept to Plant Operation

Exploring the Biomass Opportunity

As noted earlier, the District of Lillooet's Recreation Centre (REC) was heated for several decades by two separate propane fueled systems. The REC three boilers had approximately 1200 kW (4,000,000 BTU) of heat capacity. The two main boilers were a newer 300 kW (1,050,000 BTU) Viessmann boiler and an older 730 kW (2,500,000) Cleaver Brooks boiler. The Cleaver Brooks boiler was purchased used. It was installed in the early 2000's to assist with peaking heat demand for the swimming pool however, it was very costly to maintain.

Figure 3 - New Pellet Boiler System

Figure 4 - Old Propane Storage Tank

Figure 5 - Old Cleaver Brooks Boiler

In 2007 Cornelius Suchy of Canadian Biomass Energy Research (formerly Mawera Canada), was investigating a potential biomass energy project designed to utilise excess wood waste (primarily hog fuel) from a local sawmilling operation. Mr. Suchy approached the District of Lillooet's (DoL) recreation department staff to discuss the potential to convert the recreation centre heating centre to biomass. In October 2007 staff reported these discussions to the DoL Council. Council directed staff to move forward with determining potential funding sources and inviting Mr Suchy to present a more detailed project to Council. The two primary reasons for installing the new heating system were to reduce energy costs as well as help meet their GHG reduction goals. DoL is a signatory of the Province of BC Climate Action Charter. DoL staff provided information to Mr. Suchy about the propane consumption. In early 2008 Mr. Suchy completed a project concept document to determine the viability and cost of switching to biomass and presented his findings to Council. Mr. Suchy completed this report at no cost to DoL. A comparison of the actual costs to the projected costs from Mr Suchy's concept paper is included in the Appendix compendium.

In the initial planning stages of the project, the proposed fuel for the biomass system was wood residual from local sawmilling operations. The primary component of this wood waste was hog fuel. As the Biomass Energy Project (BEP) concept was further refined the decision was made to use pellets as the primary fuel source, but with the option to use wood waste residuals should conditions change. The primary reasons for switching from residuals to pellets were as follows:

1. A number of the local sawmilling operations underwent significant changes and shutdowns for extended periods as the BEP was developing. The possibility of having a non-secure local fuel source became a concern.
2. Pellets are a higher density, higher energy content and more consistent fuel source. The result is less shipping costs, reduced volume of fuel consumption for the same heat output, and less maintenance as compared to wood waste residuals.

Building Upgrades and Retrofits

As noted previously, the arena and swimming pool buildings used two different heating systems that were not connected. The BEP saw the following upgrades and retrofits take place:

- Removal of asbestos covered piping and Cleaver Brooks boiler;
- Redesign of the existing piping and heat distribution system;
- Creation of a new electrical area;
- Linking of the hot water system from the swimming pool and arena

The original project concept was to go with a design/build approach. However, when this concept was discussed with biomass equipment vendors it became clear that they would just sub-contract the building upgrades and retrofits. As a result, the DoL made the decision to split the boiler purchase contract from the building retrofit contract.

Figure 6 - New Heat Distribution Pumps

Project Development Timelines

In April 2008, the DoL applied for project funding under the Innovation Fund of the Gas Tax program funded by the Government of Canada in partnership with the Province of BC and administered by the Union of BC Municipalities. The application was completed by DoL staff (primarily Gerry Little — then DoL Recreation Director) with support from Mr. Suchy. In October 2008, DoL staff was advised that their application was successful. The public announcement was made in late 2008. The funding agreement was created in early 2009 and signed in April 2009. In 2008 Mr. Little left the DoL and Duane Lawrence became the new recreation director and project lead with support from Arden Bolton, Director of Public Works. The summer of 2009 saw Lillooet under serious threat from a number of wildfires and staff focus was shifted away from the BEP.

Fall 2009 saw a refocus on the BEP. It became apparent to staff that additional help would be needed to see the project completed successfully.

In November 2009, a Request for Expressions of Interest (see separate Appendix compendium) was used to help determine the level of biomass heating knowledge and to identify potential project managers. Based on the response to the REI, DoL staff issued a Request for Proposal in February of 2010. A number of proposals were received from a number of proponents. The DoL signed a project management agreement with Greyback Construction of Penticton, BC in March 2010. The BEP was slated to begin mid-April 2010 and to complete by November 2010 (in time for the opening of the pool). March 2010 also saw the DoL hold public consultation meetings to advise community members of the status of the BEP and address any concerns.

From April to June 2010 the main engineering work was completed. In July 2010 a tender was issued to supply a standalone 350-425 kW boiler system that would run on pellets but could also be fueled by wood chips. During the summer of 2010 preliminary discussions were held with the BC Ministry of Environment (MOE) to determine what, if any, permitting would be required for the biomass heating system. Initially MOE staff felt no permits would be required. In the fall of 2010, MOE decided that an air discharge permit would be required and so DoL staff begun the permitting process.

In August 2010 Fink Machinery of Enderby, BC was awarded the contract to supply and install a 400 kW KOB containerized pellet boiler and pellet storage system. The KOB boiler was built in Austria and then containerized by Fink at their facility in Enderby, BC. In September 2010 a tender to complete all the modifications necessary to connect the building heating systems as well as other mechanical system modifications was issued. The successful bidder was Southern Mechanical Services Inc. from Penticton, BC.

Due to a variety of delays (issuing the boiler tender, MoE permitting, and the boiler delivery time from Austria), the DoL decided to delay the beginning of the BEP installation until after the air discharge permit was received and the 2010/11 pool schedule had ended. Construction started in April 2011 and finished in June of the same year. The system was commissioned in June 2011. The system underwent start up and trouble-shooting from September 2011 to March 2012 as it was ramped up to full capacity.

The new biomass heating system consists of a PYROT 400 kW biomass boiler located in a 20' shipping container and a 45 tonne pellet silo for fuel storage. The system is located on the site where the large propane storage tanks were previously. The biomass system is now the primary heat source for the entire Recreation Complex. The new system allowed for the removal of the previous Cleaver Brooks boiler. The previous Viessmann boiler is connected to the new biomass system to provide peaking[1] and to provide back-up capacity, if for some reason the biomass system needs to be shut down.

Figure 7 - Pellet Storage Silo

Figure 8 - Viessman Peaking Boiler

EARLY 2007	Initial Discussions
OCT 2007	Decision to go forward
EARLY 2008	Feasibility Study Completed
APR 2008	Apply for Gas Tax Funding
EARLY 2009	Funding Agreements Signed
NOV 2009	REI for Project Managers
FEB 2010	RFP for BEP Manager
MAR 2010	Public Consultation Meetings
APR 2010	Greyback Construction hired as BEP Manager
SUMMER 2010	Preliminary discussions with MOE
JULY 2010	Biomass System Tender
AUG 2010	Fink Machinery selected to supply Biomass System
SEPT 2010	Mechanical System Tender awared to Southern Mechanical
LATE 2010	Air Permit recieved
APR 2011	Construction starts
JUNE 2011	Commissioning
SEPT 2011 TO MAR 2012	Start up and troubleshooting

Figure 9 - Timeline

[1] An energy peak refers to the highest demand point within the heating cycle. Most fossil fuel heating systems are designed to meet this peak demand. Biomass heating systems are designed to meet the average load throughout the heating cycle with additional heating provided by a second smaller biomass boiler or conventionally fuelled system. A well designed biomass system should supply between 80-95% of the required heat demand.

Operations and Permitting

The new biomass system is being operated by existing DoL Recreation Centre maintenance staff. The REC centre has one maintenance person responsible for the building operation including the biomass system. No additional staffing was required. While the staff member does have a 5th class steam engineer's certification it is not required for the boiler. The system requires between 2-5 hours of work each week to maintain, primarily for cleaning out ash from the bottom of the boiler. The ash is currently landfilled but could be used as a soil additive. The ash is collected in a large wheeled garbage can (see *Figure 10*) and needs to be emptied approximately every six weeks.

Figure 10 - Pellet Boiler

Lillooet receives 4 to 5 pellet fuel deliveries per year. When the pool is in operation fuel is required approximately every 2.5 months. Other times of the year, a delivery is only needed every six months. Each delivery is approximately 30 tonnes. A semi-truck and trailer from the fuel supplier arrives, augers pellets into the silo and leaves. The total time for unloading the pellets into the storage hopper is 1-2 hours and is very unobtrusive. The DoL has had no complaints about excess truck traffic or noise. Pellets are being purchased in bulk from a pellet manufacturer and supplied from either Williams Lake or Armstrong.

Figure 11 - Pellet Delivery Truck

The biomass heating project underwent a complete permit process from the Provincial Government's Ministry of Environment. The main concern is air emissions from the exhaust stack. The main requirement is a particulate emission below 50 mg/m^3. The DoL is required to test quarterly when the pool is in operation. This equates to two tests during the six month operation of the pool. The MoE has indicated that if the DoL is able to consistently test below this limit then the testing requirement could be reduced to annually or a longer time period.

Figure 12 - Ash Collection Bin

Project Construction Costs and Funding Sources

The final cost of the BEP was $705,000 including PST/GST/HST ($630,000 before taxes). $467,000 was received as a grant from the Gas Tax Innovation Fund program funded by the Government of Canada in partnership with the Province of BC and administered by the Union of BC Municipalities. The remaining $238,000 was from the DoL's REC Centre Reserve Fund and Surplus. The breakdown of costs was as follows:

Table 1 - BEP Capital Cost Breakdown

Project Management and Engineering	$111,000
Biomass Boiler	$312,000
Building Upgrades	$207,000
Total	**$630,000**
Taxes (HST/PST/GST)	$75,000
TOTAL	**$705,000**

Operating Costs

Table 2 on the next page, provides information on the fuel costs to heat the Lillooet Recreation Centre for the past five years. As noted previously, it is important to remember that while the biomass system became operational in June 2011 the system has only really been fully operational since March 2012. Propane usage in 2011 was also higher than normal because the pool had to be drained to repair leaks and refilled resulting in higher propane usage.

The REC consumes 4114 GJ of energy each year (based on 2007 and 2010 data). The average propane cost for the REC, prior to the BEP (based on 2007-2010 data), was $78,000/year. The average price of propane (based on 2007, 2010-12 data) was $20.47/GJ. In 2012, the pellet boiler supplied 80% of the heating load. This is expected to increase to 85-90% as the system becomes optimized. Based on a pellet boiler utilization rate of 85% as well as the current price of both propane and pellets, the DoL can expect to pay $31,000/year for pellets and $11,000/year for propane.

Table 2 - Fuel Cost Summary[1]

FUEL TYPE		2007[2]	2008	2009	2010	2011	Jan-Oct 2012
Propane	Volume	159,870 L	NA	NA	162,404 L	116,803 L	*26,428 L*
	Energy	4082 GJ	NA	NA	*4146 GJ*	*2981 GJ*	*675 GJ*
	Total Cost	$84,140	$68,624	$74,295	$84,556	*$62,363*	$12,157
	Price $/L	$0.53/L	-	-	*$0.52/L*	*$0.53/L*	$0.46/L
	Price $/GJ	$24.28/GJ	-	-	*$20.39/GJ*	*$20.92/GJ*	*$18.01/GJ*
Pellet	Volume	-	-	-	-	*87 tonne*	*148 tonne*
	Energy	-	-	-	-	*1653 GJ*	*2812 GJ*
	Total Cost	-	-	-	-	$15,054	$24,825
	Price $/tonne	-	-	-	-	*$173/tonne*	$167/tonne
	Price $/GJ	-	-	-	-	*$9.11/GJ*	*$8.79/GJ*
	TOTAL ENERGY COST	**$84,000**	**$69,000**	**$74,000**	**$85,000**	**$77,000**	**$37,000**
	TOTAL ENERGY USAGE	**4082 GJ**			**4146 GJ**	**4634 GJ**	**3487 GJ**

1. Values in Italics were calculated based on data provided by DoL staff
2. Data from the feasibility report completed by Mr. Cornelius Suchy, Canadian Biomass Research

The cost of propane, like all other fuels, can vary significantly. In 2007 the District of Lillooet was paying $0.53 per litre of propane (or $24.28/GJ). However, in June of 2012 the DoL was able to purchase propane for $0.46 per litre (or $18.01.12/GJ). The DoL is currently paying $167/tonne for pellets delivered to their storage unit ($125/tonne for the pellets plus $42/tonne for delivery). The price for propane and pellets from 2012 in Table 2 shows that pellets are approximately $9/GJ cheaper than propane or half the price.

The staff costs for the project were initially estimated to be $20,000. The actual staffing requirements have been far less because there is less fuel and ash handling. Based on two hours a week, staff costs are estimated to be $2,000/year (at $20/hr.) for budgeting purposes. DoL did not need to hire any new staff so in reality there are no new staff costs.

The system has not been in operation long enough to accurately determine yearly maintenance costs. In the feasibility study maintenance costs were estimated at 2% of the initial investment or $8,000. Using this method for the actual installed system, the maintenance costs can be estimated at $6,000/year over the life of the boiler.

The cost of quarterly air quality testing is $8,000/year based on the current testing schedule. This cost is expected to be reduced to once yearly with the addition of a multi-cyclone and moving to an improved testing approach. More details of this are contained in the ***Breaking New Ground*** section. The final cost of testing is expected to be $4,000/year.

The total yearly operating costs for the BEP are $52,000 and are summarized in *Table 3*. The average yearly propane cost prior to the BEP was $78,000. The result is that the DoL can expect to see approximately $26,000/year in savings.

[2] When comparing the fuel costs of different energy system the cost per unit of fuel, ($/litres in the case of propane) needs to be converted to a cost per unit of energy and in this case gigajoule (GJ). It is also important to include all the costs to the point of consumption. This would include delivery charges, fees, equipment rental, and in the case of fossil fuels carbon taxes. These fees can represent a significant portion of the total energy cost. For example, only 1/3 of the cost for natural gas is the commodity price. The remaining 2/3 is fees, delivery charges, etc.

Table 3 - BEP Yearly Operating Costs and Savings

BEP Yearly Operating Costs	Yearly Cost
Pellets	$31,000
Propane	$11,000
Staffing	$0
Maintenance (over the life of the project)	$6,000
Testing	$4,000
Total BEP Yearly Costs	**$52,000/year**
Yearly Costs prior to BEP	**$78,000/year**
Saving Due to BEP	**$26,000/year**

After 2 or 3 years of operation it will be possible to get a more accurate indication of the savings that the DoL is actually realizing from fuel switching to pellets. While the price of all fuels will undoubtedly continue to fluctuate an annual operating savings of $26,000/year is very significant to a municipality of Lillooet's size. As noted earlier it also assists the DoL in meeting their carbon reduction targets.

Project Capital Payback

There are number of different ways to calculate return on investment or project capital payback period. The BEP has not yet been fully operational for a full year so capital payback projection is based on the assumptions noted above.

The building upgrades and retrofit parts of the project represent changes to the building envelope that would have taken place regardless of whether or not the District of Lillooet had installed a biomass boiler or a new propane boiler. They were primarily completed to take advantage of synergies available by completing the upgrades and boiler installation at the same time.

The total cost of the BEP was $705,000, of which $411,000 was for installing the biomass boiler (i.e. $349,000 for the boiler and 50% of the project management and tax costs). If one reduces the total boiler cost by applying the same leverage ratio from the Gas Tax Grant, then the actual cost to the DoL for the biomass boiler was only $140,000.

Table 4 - Funding Ratios

Funding Source	Complete Project	Leverage	Biomass Boiler
Gas Tax	$467,000	66%	$271,000
DoL	$238,000	34%	$140,000
TOTAL	**$705,000***	**100%**	**$411,000****

*including PST/GST/HST
**includes $349,000 boiler and half of project management $62,000

In order to determine the Rate of Return it is useful to determine the Business as Usual scenario (BAU). In the BAU scenario, propane would still be used as the main fuel at a cost of $78,000/year. DoL has indicated that there were substantial maintenance costs to the propane system. These avoided costs were not included in this analysis. The actual operating cost for the BEP is $52,000/year, with savings of $26,000/year over the BAU. The simple payback for the DoL investment in the boiler is 5 years (based on the above ratios). If the DoL did not receive any grants and installed the boiler system, the simple payback would have been 16 years. The simple payback for the entire BEP is 9.2 years.

The Net Present Value (NPV) (based on 15 year term (conservative estimate of the useable life of a biomass boiler) and 7% discount rate and an upfront investment of $140,000) is $97,000. Once again had the DoL undertaken the boiler installation without any grants the NPV would have been -$21,000. The NPV for the entire BEP system is $152,000. The Internal Rate of Return (IRR) is 17% and 7% for the boiler system and entire BEP. All this information is summarised in *Table 5*.

The rates of return (Simple payback, NPV, IRR) in *Table 6* indicate that both the installation of the biomass boiler and the entire BEP were good investments for DoL. The installation of the biomass boiler only, would have been a marginal project for the DoL without any grants. If avoided costs from both carbon offsets and reduced maintenance costs had been included in the analysis the rates of return would have improved significantly.

Table 5 - Rate of Return

	Boiler System Only Actual	Boiler System Only No Grants	Entire BEP Actual
Total Project Capital Investment	$411,000	$411,000	$705,000
DoL Investment	$140,000	$411,000	$238,000
Savings	$26,000	$26,000	$26,000
Simple Payback	5.4 Years	15.8 Years	9.2 Years
Net present Value (15 years and 7%)	$96,806	-$21,000	$152,000
Internal Rate of Return	17%	-1%	7%

Other Benefits of the BEP

One of the major other benefits for DoL is that the community has now started to gain an understanding of how biomass can be used for heat. As the cost of fossil fuels and electricity increase, other commercial users will be better able to understand how biomass works and it will be easier to adopt. The use of pellets also acts as a stepping stone for a more locally produced biomass fuel source such as wood chips. By creating a local demand for biomass fuel, the DoL is hopeful that their actions might stimulate private sector investment in biomass fuel development supply and delivery.

The Benefit of Hindsight – Lessons Learned

The BEP has been a very successful project, however there have been some interesting lessons learned.

Knowledge Base

The DoL made the good decision to separate the project into two components, the biomass boiler and the building retrofits. A single project manager was hired to manage both. During construction, a decision was made to remove a previously planned heat exchanger that would separate the biomass boiler heating fluid from REC centre heating system fluid. The heat exchanger was part of the initial design program and RFP. Once construction started it was removed from the building retrofit construction activities to save costs, over objections from the boiler supplier.

The biomass boiler is an open loop system (non-pressurized heat storage) while the arena heating system was a closed loop system (pressurized heat storage). The result is that the system could not maintain proper pressure and would not operate effectively. In March 2012, the heat exchanger was finally installed and the problem was resolved. The heat exchanger, while technically part of the building retrofit, was a critical piece of the boiler system interface. This situation was resolved in a relatively simple inexpensive manner but it could have degenerated into a significant issue over who is responsible to fix the problem and significant cost.

There are a small number of biomass heating installations currently in BC and a lack of knowledge about how they operate and their design. This highlights how important it is to have decision makers and, more importantly, their advisors understand some key fundamentals about biomass heating projects.

Figure 13 - New Heat Exchanger

Breaking New Ground

When the DoL decided to go forward with the BEP, it was the first biomass boiler that was providing building heat, AND heating water for a swimming pool. Currently the MoE does not regulate emissions from 'comfort heating'. This term is typically applied to heating of buildings and domestic hot water.

Other biomass boilers in the province have not required operations permits. Early on in the project, Lillooet approached the MoE to determine if an air discharge permit would be needed. Initial thoughts were that no permit would be required. As the BEP progressed, and after the RFP for the biomass boiler and associated equipment was completed, the MoE reviewed the BEP. It was decided a permit would be required because the heating of the pool water went beyond 'comfort heating'. It is worth noting that the MoE is working on better defining when a permit would be required for biomass heating and this also varies from region to region. While the actual permitting process was not difficult it did contribute to the delay in the BEP going forward and has had further trickle down impacts.

Permitting – The Trickle Down Effect

The MoE air discharge permit for the biomass boiler has been set at 50 mg/M^3. This value is marginally higher than the manufacturers stated emissions for the boiler (which have been verified by an independent third party in Europe) and therefore air quality emissions equipment should not be needed to meet the permit. The value of 50 mg/M^3 is approximately three times lower than most areas in Austria (where biomass heating has been widely deployed). It is below the level at which smoke can be detected visually.

Initially, the permit required independent quarterly testing based on full load operation. This testing added an additional $16,000 a year to the operating cost.

In the initial test, under good loading in the winter, the system was below the permit level. The next tests were carried out in conditions when the boiler was not able to be maintained at the required loading for the testing period. The boiler would not normally be in operation under these conditions because the demand is not large and sustained enough. As a result, the boiler cycling led to higher than normal particulate emissions, but still below typical European standards. The MoE has recognised the loading as a significant issue and has not updated the permit so that testing is required quarterly, when the pool is in operation. This should result in only two tests per year. DoL staff are also confident that if they can show consistent results below the permitted level the testing requirement will be lessened to a yearly basis.

It is worth noting that since the system was first started up in June 2011 to the writing of this case study (Sept. 2012), neither the DoL nor the MoE have had any complaints about emissions from the system.

The DoL is looking to install a 400 kW multi-cyclone air cleaning system which should allow the biomass boiler system to exceed the permit requirements. The cost of the cleaning system is approximately $22,000. It should allow the DoL to only require yearly testing thus having a less than 2 to 3 year payback. Had the DoL known they would be required to meet such a stringent emission permit the multi-cyclone would have been included in the initial RFP.

Fuel Quality/Handling

The DoL made the decision to purchase bulk pellets from a local company that sells residential bagged pellets. Initial pellet quality was good and there were no issues (as evidenced by initial emissions testing). However, high amounts of sawdust, which can potentially lead to higher particulate discharge, were being detected in the fuel supplied to the boiler. This led to discussion between the DoL and the pellet manufacturer. The high level of sawdust could also have contributed to DoL not meeting emission levels.

Figure 14 - Auger from Pellet Silo into Boiler Container

Figure 15 - Pellet Feed System Inside Boiler Container

Sawdust in the boiler feed occurs for two main reasons. The first is that the sawdust is actually present in the pellets from the manufacturer. The second is during delivery and handling the pellets are subjected to excess harsh conditions. The pellets initially used by the DoL were an industrial/brown pellet which is designed for larger systems, particularly co-firing in large power plants. DoL has switched to a different pellet manufacturer and is purchasing a more premium white pellet, which is what most residential consumers use. The switch took place in Feb/March of 2012. It is hoped that once all of the old fuel has been consumed the newer white pellet fuel should reduce the amount sawdust. The next step is to look at the fuel delivery system and ensure no breakage is occurring while transiting from the plant to Lillooet or the transfer from the truck to the fuel storage silo.

Separate Appendix Compendium Package Material:

Appendix 1 – Biomass Information Bulletin
Appendix 2 – Biomass Boiler Tender RFP Addendum
Appendix 2 – Biomass Boiler Tender RFP
Appendix 3 – Project Management RFP
Appendix 4 – Pre-feasibility Study Wood Heating
Appendix 5 – Request for Expressions of Interest
Appendix 6 – 2008 Report to Council
Appendix 7 – Draft Permit for MOE
Appendix 8 – Interior Health letter