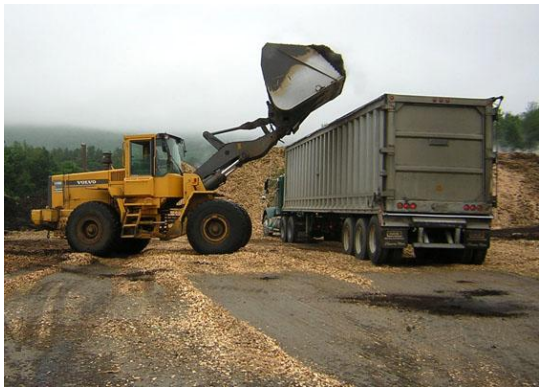
BC LEADERS FUELS FOR SCHOOLS TOUR REPORT:

LESSONS LEARNED FROM VISITING FOUR MONTANA PUBLIC SCHOOL WOOD BIOMASS HEATING SYSTEMS



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SCR MANAGEMENT INC.

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Rocky Mountain TRENCH NATURAL RESOURCES SOCIETY

SCR Management Inc.

Rocky Mountain Trench Ecosystem Restoration Program
Restoring Nature's Balance.

R.W. Gray Consulting

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OVERVIEW

The Fuels for Schools Tour was well represented as a total of 27 people participated on the tour. The tour was supported by the Rocky Mountain Trench Natural Resources Society, Columbia Basin Trust, BC Bioenergy Network, Rocky Mountain Trench Ecosystem Restoration Program, SCR Management Inc., and R.W. Gray Consulting.

The tour was coordinated by SCR Management Incorporated assisted by Rocky Mountain Trench Natural Resources Society staff, which included Tom Hobby (CEO-SCR) and Mike Gratz (Agrologist-SCR), along with Dan Murphy (Coordinator RMTNRS). Tour participants included the following breakdown of attendees and leaders. The complete list of participants is provided in Appendix A.

- 4 First Nations representatives
- 1 Mayor
- 5 School District board and/or staff members
- 5 Municipal staff/executive
- 2 NGOs
- 1 Pellet manufacturer
- 1 Media
- 2 Academics
- 4 Consultants
- 1 USFS Fuels for Schools Staff
- 1 Montana DNR staff

The tour group visited 4 public schools in Northwestern Montana (Appendix B), where the boiler operators met with the tour group at 3 sites (Eureka, Kalispell, Thompson Falls) and the boiler operator and principal met with us at Morrison Elementary in Troy, MT. The hosts provided the tour group technical and development information about the thermal heating systems that have been operating at these schools.

PROMOTIONS

The tour was promoted via an email list serve to over 350 people within the Columbia Basin region with personal phone calls being made to all First Nations Bands, school district superintendents, facilities managers, municipal mayors and Regional Districts. Two local MLAs (the Honorable Bill Bennett and Norm MacDonald) were personally contacted for a total of over 60 personal calls being made to promote the tour. The tour was also promoted to over 1000 members/companies through the BC Bioenergy Network via email, and was promoted on the Green Heat Initiative's website. Local newspaper ads were posted in the East and West Kootenays for 2 weeks.

TOUR OBSERVATIONS AND LESSONS LEARNED

EUREKA, MONTANA – LINCOLN COUNTY HIGH SCHOOL

This site had 3 schools networked: an elementary, Jr. High and Sr. High, all connected via a steam boiler system. The original school and (fuel oil) boiler was built and installed in 1919, which is still operating as the back up to the wood biomass system.

Details:

- Boiler System - Messersmith feed handling system with a 6MM BTU/Hr Hurst Boiler;
- Fuel Source - began operations in 2007 burning hog fuel that was too dirty and led to boiler problems and excessive wear on the feed handling system. They subsequently had to switch to cleaner fuel, which they now use paper grade fuel (peeled-whole tree chips);
- Moisture content of chips ranges from 18-40%; >45% MC leads to boiler problems, smoke etc.
- Chip prices discounted due to subsidies from $65/GT to $30/GT;
- Economics of fuel oil comparison to wood chips is estimated at $80/GT breakeven;
- USDA Grant $400k USD for capital costs supported the conversion to biomass;
- Project Cost: $1.32 MM
- Carbon Credits were sold for 15 years for the offset of fossil fuels for an est. $100K USD – credits sold to the Climate Trust.

Lessons Learned:

- Noticed that burning certain varieties of trees had better BTU's - preferred Fir/Larch;
- Conversion to wood biomass was a simpler decision to convert due to the fact that all 3 campuses were in close proximity and already using a central steam system;
- Financed with grants and low interest loans that made the project affordable;

- Would possibly change chip storage system to an underground system vs. an above ground storage system. An underground system would allow easier load delivery/receiving as when a load arrives, it would be able to be offloaded vs. having to wait for an empty storage shed. An est. $60k would be required to retrofit. The only downside to an underground storage system would be the situation where a bad load of chips arrived and was unloaded. In this situation, it would have to be burned as it would not be feasible to remove the chips from an underground system;
- They have had no community issues with smoke or using wood biomass for heating the school.

KALISPELL, MONTANA – GLACIER HIGH SCHOOL

This school is an enclosed footprint of 220,000 square feet and the PES/Solagen wood boiler system was part of the design and construction of the new facility in 2006. The boiler was commissioned in January 2007.

Details:

- Boiler was able to handle 100% of load at this site; very little need for using back up boilers, which means they save the maximum using wood chips vs. fossil fuels;
- Attempted to use hog fuel at the start, but have switched to cleaner chips
    - Less wear and tear on feed handling equipment
    - Less ash and issues with rocks and clinkers
    - Less issues with smoke due to moisture content variability
- A cyclone and taller stack 30' was added to reduce emissions and sparks;
- Feedstock supplier has a deliver or pay clause in the contract. In this case, if they don't deliver, the cost of running the system on gas was approximately $400/day;

Lessons Learned:

- Don't design the system within the main school footprint due to noise. The music sound room was built on top of the boiler room;
- Lodgepole Pine – Beetle killed fibre has been a problem due to rot in the wood which causes the log to create stringers 6' long when chipping. This has been problematic for the feed handling system;
- Hot water systems are much easier to maintain than steam systems;
- Water softening system was put in to avoid issues with hard water;
- School Board selected the lowest bid, which led to a major retrofit after commissioning that cost >$100k;
    - Cheaper to design and build a new construction system. $550k for boiler and feedstock handling vs. $1.32 MM at Eureka for a similar 6MM BTU/Hr systems

THOMPSON FALLS, MONTANA – HIGH SCHOOL

Thompson Falls has a Chiptec feed and boiler system that produces steam for their multi-school and dormitories. They have a fuel oil back-up boiler that supplies heat on peak days and as a backup should the wood boiler be out of service.

Details:

- Pulp chips were used as they too attempted to use hog fuel in the first year of operation;
- Pay $75/ton for white wood chips from St. Regis;
- Thermal efficiency of Chiptec boiler is equivalent to the other systems seen (i.e. Hurst, Solagen), even though Chiptec sells their boiler as a 'gasification' system;
- Fuel oil boiler running would consume 300-400 gallons per day @$3/gallon
- Project cost: $400K

Lessons Learned:

- Building too small and system was not engineered correctly to be user friendly. Too little space for feed handling;
- Manual feed handling may be cheaper, but takes a lot of manpower and equipment and requires daily attending, which is costly;
- Retrofit engineering and construction was also required by the school as the original installed system had many glitches. Messersmith was the key company to resolve the issues for both Glacier HS and Thompson Falls;
- Design – make sure that the system functions for the operational staff, i.e. doors have clearance, no issues with fire exposure, access to key components, i.e. motors, doors, moving parts;
- Key training for operations staff is essential;
- Steam systems are hard to operate with low loads;
- No controls for the boiler temp, but only stack temp to use as a guide, which could be improved upon; other regulating systems would be beneficial;
- Annual contract for fuel is given by select invitation only;
- System engineered to run at 85% of peak load to maximize boiler efficiency; wood boiler system is backed up for peak load by the fuel oil boiler.

TROY, MONTANA – MORRISON ELEMENTARY SCHOOL

Morrison Elementary has a Decton wood pellet heating system, which heats a 33,000 sq.ft. facility that has been in operation since 2008. The pellet heating system was essential for the school as there were space limitations and the ability to incorporate a fuel handling system that required additional space was not feasible, which limited their fuel choice to a pellet system.

Details:

- Decton Wood Pellet Boiler System installed at site
    - Burnham Commercial/American Boiler
- Pellets are supplied by Eureka Pellet Mill (2hrs haul);
- Boiler room footprint 25x25 – just moved oil boiler over and re-plumbed the pellet boiler in the same room;
- Pellet feedstock storage footprint approx 20x20
- Project Cost: $250k

Lessons Learned:

- Space limitations were conducive for switching to a pellet system and feed handling system due to smaller footprint requirements;
- Pellets are more expensive than chips, but ease of use and consistent burn allows for management efficiencies;
- Savings for the school were less than using wood chips, but still attractive enough to switch;
- The pellet system would not require much more operational supervision than the previous fuel oil system and therefore staff was supportive of the changes;
- Use pellet boiler most of the year when full loads are needed. Hard to run a steam system on the shoulder seasons; they still use oil boiler for early fall and late spring;
- Pellets – were an almost dustless operation – cleaner than wood chips; all the other schools were very meticulous about keeping boiler rooms clean to prevent spontaneous combustion;
- Townspeople welcomed the change to wood pellets because they burn wood as well – no community resistance.

GENERAL COMMENTS REGARDING ALL SYSTEMS

- All systems had back up boilers (gas, diesel); maximum thermal efficiency for wood boilers was to engineer the system to run at 85% of peak load;
- Compared to gas fired boilers, biomass boilers demanded more attention and time from the boiler operator, yet all agreed that the marginal increase in time to operate was justified by the cost savings and were very supportive of the changes;
- All systems showed a large reduction in heating costs when compared to gas;
- Biomass for all systems was found locally within a few hours of town;
- In the creation of new bioenergy systems, engineers should be familiar with issues revolving around systems already built to avoid the need to retrofit systems;
- Hot water systems were easier to maintain/run;
- Most of the schools had to extend the height of the stack as there were problems with sparks or soot;
    - Virtually all that comes out of the stack is steam. Only spot monitoring of emissions is done as continuous emissions reporting is not cost effective today. No communities have had problems with emissions or complaints about smoke.

KEY LESSONS FROM THE EDUCATION SESSION

- WUI areas need to be treated because of the threat of forest fuels fire hazard surrounding communities;
- Ecosystem restoration and WUI fuels reduction have similar objectives, yet have other exclusive objectives as well;
- In treating high fuel hazard WUI areas, fuel treatments would create an ample supply of biomass for heating – hence the opportunity to install bioenergy units;
- Larger scale biomass facilities are needed to support small-scale bioenergy systems to have a willing supply of fuel as small volumes required for school systems would be an economic limiting factor for fuel suppliers if only small-scale systems were the only demand in a region;
- In Montana and other western states, partnerships were key for successful thermal biomass energy development;
- Building locally owned biomass energy (large-scale) facilities would reduce industry risk caused by outside investment, which has consistently lacked community commitment.

COMMENTS FROM POST TOUR SURVEYS

WHAT KEY INFORMATION DID YOU TAKE HOME FROM THE TOUR?

- I took home a much better understanding of the benefits both economic and environmental of burning bioenergy vs fossil fuels.
- Smaller plants require high quality fuel - pellet burners may be more economical long term - small scale electricity generation with biomass not economic - yet
- When making choices as to how heat buildings there are many choices that public building operators need to consider. The choice made needs to reflect current system efficiencies as well as take into account anticipated future costs.
- I believe that the systems installed in the four Montana sites we visited are good choices for their respective jurisdictions. I am also impressed with the level of technology of the equipment at the sties. The performance and efficiency of this equipment is really quite outstanding. In addition, the passion, commitment, and buy-in of the operators was clearly evident. Without their commitment the success of these systems would/could be in doubt. That being said I do not think this technology is appropriate or applicable for School District No. 8 (Kootenay Lake) and the many sites we operate. Specifically, I perceive the drawbacks to applying this technology to SD8 are as follows: In terms of overall systems comparisons and construction costs, geo-exchange is our preferred option over bioenergy. In terms of optics, bioenergy systems would not be a viable option for urban areas despite the efficiency of the systems I saw in Montana. In terms of cost effectiveness, I believe the edge is still with geoexchange systems. Bioenergy systems are material dependent and, over time, costs are assuredly going to go up. Also, bioenergy systems appear to be labour intensive. With an hourly rate of almost $40 (wages, benefits, training etc), managing such a system in-house is quite costly for us.
- I learned a great deal about heating with wood fiber. I learned that fiber is a viable alternative to fossil fuels and that with the proper planning and implementation the heating plant installation shouldn't require extraordinary levels of supervision or staff.
- It is possible to have succesfull bioenergy projects.
- Fuel quality is key.
- Wood chip fueled boiler cost savings. The common mistakes made by the various schools. The name of the best company that specialize in retrofiting boilers to the chip burning technology.
- We are interested in all aspects of biofuels production and utilization for domestic use and processing biofuels for economic benefit. Everything we learned on the tour will be considered as we move forward in the potential use of this technology.
- We had no idea that this technology was being used to the extent it is by our nearby neighbours nor the

significant cost savings that result.

HOW WILL THE INFORMATION THAT YOU HAVE LEARNED BENEFIT YOUR ORGANIZATION?

- It will help us to make an informed decision on the viability of Bioenergy in our School District, as well as learning some of what works and what doesn't work when building a system.
- It won't directly - the benefit we seek is a second market for pulp grade logs to absorb fiber from ecosystem restoration operations - we hope the tour will motivate institutional building owners/operators in the Trench to heat with wood chips/pellets.
- It is always preferred to have all relevant information about choices on hand whenever decisions are being made.
- I have moved the information forward and am hoping that College of the Rockies will entertain the utilization of biomass in its heating needs.
- I am also hopeful that I will be able to use some of the information, contacts and experience to incorporate biomass into a planned alternate energy program.
- It will help build a succesfull proposal for a bioenergy feasibility study for UBC Research Forest.
- We are interested in all aspects of biofuels production and utilization for domestic use and processing biofuels for economic benefit. Everything we learned on the tour will be considered as we move forward in the potential use of this technology.
- We will be conducting further investigation on options for small scale power generation and/or for district heating, from biomass and how it may be used in a small Village with 350 homes.

WERE THERE ANY ASPECTS OF BIOENERGY SYSTEMS THAT SHOULD HAVE BEEN ADDRESSED?

- I thought the piece was lost where burning slash was going to be part of the puzzle but in fact the schools that initially tried to use hog fuel found it very troublesome so they switched to pulp quality chips.
- The risk of price increases of the chip/pellet supply in relation to oil and natural gas.
- The issue of material quality needs to be dealt with. Three of the sites tried to burn hog fuel and found this to be problematic. Even the pellet process issues concern about material quality. It was apparent that the quality of the material to be burned has a direct impact on running costs of the system.
- Would have liked to have seen co-gen demonstrated. This really is applicable to larger installations like the main campus at the college, or perhaps the Rec Plex with the city.
- Comparision with propane, natural gas and heating oil would have been interesting to have.
- I don't believe we were dealing with for the most part a specific system and I think we were well informed in that regard.
- Biomass power on a micro scale

DO YOU HAVE ANY ADDITIONAL SUGGESTIONS FOR THE UPCOMING FALL WORKSHOPS?

- Maybe it would be helpful to have a bioenergy boiler manufacturer/supplier speak to us.
- The forest tenure system and its role in blocking or facilitating fiber supply for a new bioenergy industry in the Trench (2) measuring the ecological benefit from the current harvest strategies for the ER program in the Trench - has activity become the goal?
- A discussion, slide presentation etc on co-gen/tri-gen would be helpful.

EVALUATION SURVEY

For the following questions, how would you rate the following:

1 = Needs Improvement, 2 = Satisfactory, 3 = Good, 4 = Excellent

Overall organization of the tour: 1 ☐ 2 ☐ 3 ☐ 4 ☐

Overall impression of meals: 1 ☐ 2 ☐ 3 ☐ 4 ☐

Overall impression of accommodation: 1 ☐ 2 ☐ 3 ☐ 4 ☐

Quality of information obtained from the tour sites: 1 ☐ 2 ☐ 3 ☐ 4 ☐

Quality of education session (Mon. evening): 1 ☐ 2 ☐ 3 ☐ 4 ☐

Averaged scores from tour questions n=7

Tour organization: 4.0

Meals: 3.75

Accommodations: 3.75

Quality of info obtained on the tour: 3.63

Quality of the education session: 3.75

OVERALL COMMENTS:

- It was a great tour. I learned a lot about bioenergy from the education session as well as talking to the hands-on people at the schools.
- Very good.
- Very well done. The contacts that I have made through this tour have been very worthwhile.
- Very well organized tour and very informative. Thank you.
- Very informative, over all well worth it.
- Outstanding tour. Seeing operations in person and hearing from system operators was fantastic.

APPENDIX A – ATTENDEE LIST

Tom	Hobby	CEO	SCR Management Inc.
Mike	Gratz	Agrologist	SCR Management Inc.
Bob	Gray	Fire Ecologist	R.W. Gray Consulting Ltd.
Dan	Murphy	Coordinator	Rocky Mountain Trench Natural Resources Society
Steve	Morisette	Director Operations	School Dist. 20
Craig	Edwards	Energy Manager	School Dist. 6
Brian	Watson	Forestry Manager	Nupqu Development Corp.
Arne	Dohlen	Approvals Officer	Village of Radium Hot Springs
Dan	Wigle	Natural Resource Officer	St. Mary's Indian Band
Larry	Brown	Director of Operations	School District No. 8 Kootenay Lake
Scott	McLeod	Aboriginal Youth Intern (Representing the director of community and economic development	St. Mary's Indian Band
Kevin	Szol	Coordinator, Trades Programminng, Instructor, Electrical Programs	College of the Rockies
Kevin	Weaver	Economic & Business Development Manager	City if Cranbrook
David	Love	Manager of Strategic Initiatives	Town of Golden
Greg	Anderson	Manager, Ecosystem Restoration/ Policy Legislatio	Ministry of Forests and Range, BC Government
Al	Neal	Provincial ER Strategic Planner	Range Branch, Ministry of Forests and Range, BC Government
James	Oler		Bountiful Elementary- Secondary School
Merrill	Palmer	Principal	Bountiful Elementary- Secondary School
Marion	Warnica	Reporter	Jim Pattison Broadcast Group
Ralph	Gravelle		Tobacco Plains
Bruce	Woodbury	Mayor	Village of Canal Flats
Al	Collinson	Fire Chief	City of Kimberley
Maurice	Hansen		Rocky Mountain Trench Natural Resources Society
Kim	Beckman	General Manager/ Sales and Logistics	Pinnacle Pellet Armstrong Inc.
Ionut	Aron	Research Coordinator	UBC Malcolm Knapp Research Forest
Julie	Kies-Anders	Fuels For Schools	Montana Dept. of Natural Resources
Dave	Atkins		USFS - Fuels for Schools Mgr.

APPENDIX B - TOUR AGENDA

June 21 – Day 1

Site 1 – Eureka, Montana – Lincoln County High School

Eureka High School has a Messersmith heating system that has been in operation since 2007, heats 178,000 sq. ft., cost $1,320,000, estimated annual fuel cost savings $103,000.

Site 2 – Kalispell, Montana – Glacier High School

Glacier High School has a PES/SolaGen/Messersmith heating system that has been in operation since 2007, heats 220,000 sq. ft., $525,000, estimated annual fuel cost savings $100,000.

Education Session

After the first day tour, there will be a 90 minute educational session that presents linkages between community wildfire planning and ecosystem restoration with bioenergy development opportunities within the Columbia Basin region. The presenters will provide a short presentation and a panel discussion will follow that will be led by Dan Murphy (RPF), Coordinator of the Rocky Mountain Trench Natural Resources Society.

The panel included:

Greg Anderson—BScF, MScF
BC Ministry of Forests and Range
Ecosystem Restoration/Policy & Legislation Manager

Robert Gray – Fire Ecologist - R.W. Gray Consulting

Dave Atkins – UDFS Montana Fuels for Schools Program

Julie Kies Anderson – Montana Department of Natural Resources

Tom Hobby – MBA, MA, MSc., P.Ag SCR Management Inc.

June 22 – Day 2

Site 3 – Thompson Falls, Montana – Thompson Falls High School

Thompson Falls High School has a Chip-tec heating system that has been in operation since 2005, heats a 60,500 sq. ft. facility, cost $400,000, est. savings per year $60,000.

Site 4 – Troy, Montana, Morrison Elementary School

Troy High School has a Decton wood pellet heating system, which heats a 33,000 sq.ft. facility, cost $299,999, and has been in operation since 2008.