

## EVALUATION BIOMASS HEATING PLANT Castlegar Recreation Complex, RDCK

<b>Business-as-Usual Scenario (natural gas):</b>	<b><u>worst case scenario</u></b>	<b><u>probable scenario</u></b>	<b><u>best case scenario</u></b>
expected annual gas consumption	7,500 GJ/yr.	10,000 GJ/yr.	12,000 GJ/yr.
gas expenditure in 2013:			
annual increase	<b>1.3% per year</b>	<b>18.0% per year</b>	<b>30.0% per year</b>
excl. carbon tax	\$58,000 per year (at 7.80 \$/GJ)	\$123,000 per year (at 12.32 \$/GJ)	\$198,000 per year (at 16.48 \$/GJ)
<b>incl. BC carbon tax</b>	<b>\$70,000 per year</b> (at 9.30 \$/GJ)	<b>\$138,000 per year</b> (at 13.82 \$/GJ)	<b>\$216,000 per year</b> (at 17.98 \$/GJ)
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<b>Natural Gas Price Forecast</b>	<b><u>worst case scenario</u></b>	<b><u>probable scenario</u></b>	<b><u>best case scenario</u></b>
	<i>commodity &amp; delivery</i> ++	<i>commodity &amp; delivery</i> ++	<i>commodity &amp; delivery</i> ++
	<i>annual increase</i>	<i>annual increase</i>	<i>annual increase</i>
2010	\$7.50 per GJ <b>1.3%</b>	\$7.50 per GJ <b>18.0%</b>	\$7.50 per GJ <b>30.0%</b>
2011	\$7.60 per GJ    1.3%	\$8.85 per GJ    18.0%	\$9.75 per GJ    30.0%
2012	\$7.70 per GJ    1.3%	\$10.44 per GJ    18.0%	\$12.68 per GJ    30.0%
2013	\$7.80 per GJ    1.3%	\$12.32 per GJ    18.0%	\$16.48 per GJ    30.0%
<b>2013 incl. carbon tax</b>	<b>\$9.30 per GJ</b>	<b>\$13.82 per GJ</b>	<b>\$17.98 per GJ</b>
	<small>++ excl. HST</small>		
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<b>Technical Data Biomass Boiler</b>			
max. thermal output:	1.4 MBTU/h	41 BHP	400 kW
firebox input capacity	2 GJ/h		
peak & back-up gas boiler capacity:	2.6 MBTU/h	79 BHP	770 kW

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<b>Biomass Fuel Specifics:</b>							
moisture content wood fuel:		30% (MPB bole chips)					
bulk volume of fuel:		0.30 t/m <sup>3</sup>		1.7 t/unit		19 lb/cft	
calorific value:		18.0 GJ/BDT*		11.8 GJ/tonne (wet)			
max. hourly fuel consumption:		0.1 BDT*/h		0.1 t/h (wet)		0.4 m <sup>3</sup> /h	
max. daily fuel consumption:		3.2 t/day (wet)		10.8 m <sup>3</sup> /day		0.13 truck load**s/day	
		<b>worst case scenario</b>		<b>probable scenario</b>		<b>best case scenario</b>	
annual fuel consumption:		490 t/yr. (wet)		750 t/yr. (wet)		1,080 t/yr. (wet)	
		300 BDT/yr.		500 BDT/yr.		800 BDT/yr.	
		27 truck load**s/yr		5 truck load**s/yr		60 truck load**s/yr.	
		* BDT: bone dry metric tonne		** 53' truck		(18 bdt per truck)	
<b>Biomass Fuel Costs:</b>							
		<b>worst case scenario</b>		<b>probable scenario</b>		<b>best case scenario</b>	
		<i>commodity price</i>	<i>annual increase</i>	<i>commodity price</i>	<i>annual increase</i>	<i>commodity price</i>	<i>annual increase</i>
fuel costs per tonne:	2010	\$45 per wet tonne	1.3%	\$30 per wet tonne	5.0%	\$10 per wet tonne	20.0%
	2011	\$46 per wet tonne	1.3%	\$32 per wet tonne	5.0%	\$12 per wet tonne	20.0%
	2012	\$46 per wet tonne	1.3%	\$33 per wet tonne	5.0%	\$14 per wet tonne	20.0%
	2013	\$47 per wet tonne		\$35 per wet tonne		\$17 per wet tonne	
		66.8 \$ per BDT		49.6 \$ per BDT		24.7 \$ per BDT	
		4.0 \$/GJ		3.0 \$/GJ		1.5 \$/GJ	
trucking costs:		50 \$/truck load**		100 \$/truck load**		150 \$/truck load**	
		0.2 \$/GJ		0.5 \$/GJ		0.7 \$/GJ	
fuel & fuel trucking costs:		-\$21,000 per year		-\$17,000 per year		-\$11,000 per year	
		* BDT: bone dry metric tonne		** 53' truck		(18 bdt per truck)	
<b>Biomass Heat Production:</b>							
		<b>worst case scenario</b>		<b>probable scenario</b>		<b>best case scenario</b>	
annual full operating hours <sup>2</sup> :		3,438 h/yr.		5,208 h/yr.		7,500 h/yr.	
annual heat production:		4,950 GJ/yr.		7,500 GJ/yr.		10,800 GJ/yr.	
<b>Annual CO2 Abatement:</b>							
		<b>worst case scenario</b>		<b>probable scenario</b>		<b>best case scenario</b>	
emission reduction:		290 t of CO2 per yr		440 t of CO2 per yr		640 t of CO2 per yr	
(potential future) carbon credits <sup>1</sup> :		\$4,400 per year		\$6,600 per year		\$9,600 per year	
		15 \$/tonne of CO2 (50 kg of CO2 per GJ of natural gas)					
		<sup>1</sup> not taken into account at the current stage					

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<b>Residual Gas Consumption</b>	<b><u>worst case scenario</u></b>	<b><u>probable scenario</u></b>	<b><u>best case scenario</u></b>
residual gas consumption:	2,600 GJ/yr.	2,500 GJ/yr.	1,200 GJ/yr.
residual CO <sub>2</sub> -emissions:	35% of previous 130 t of CO <sub>2</sub> /yr.	25% of previous 130 t of CO <sub>2</sub> /yr.	10% of previous 60 t of CO <sub>2</sub> /yr.
residual gas costs in 2013:	\$24,000 per year	\$35,000 per year	\$22,000 per year
gas savings:	\$46,000 per year (at 9.30 \$/GJ, incl. carb)	\$103,000 per year (at 13.82 \$/GJ, incl. tax)	\$194,000 per year (at 17.98 \$/GJ, incl. tax)
<b>Biomass Steam Plant Capital Costs:</b>	<b><u>worst case scenario</u></b>	<b><u>probable scenario</u></b>	<b><u>best case scenario</u></b>
biomass boiler plant, turnkey	-\$300,000	-\$280,000	-\$250,000
emission control (filters)	-\$80,000	-\$60,000	-\$40,000
hook-up & retrofit inside boiler room	-\$50,000	-\$30,000	-\$10,000
contingencies (10%)	-\$43,000	-\$37,000	-\$30,000
total capital expenditure:	-\$473,000	-\$407,000	-\$330,000
Government Subsidy:	\$0 (0% of total)	\$101,750 (25% of total)	\$165,000 (50% of total)
net capital expense:	-\$473,000	-\$305,250	-\$165,000
<b>annuity:</b>	<b>-\$97,000 per yr.</b>	<b>-\$54,000 per yr.</b>	<b>-\$23,000 per yr.</b>
assumed depreciation period:	7 years	8 years	10 years
depreciating/interest rate:	10.0% p.a.	8.5% p.a.	7.0% p.a.
<b>Annual O &amp; M costs:</b>	<b><u>worst case scenario</u></b>	<b><u>probable scenario</u></b>	<b><u>best case scenario</u></b>
maintenance costs:	-\$9,000 3.00%	-\$7,000 2.50%	-\$5,000 2.00%
wood fuel and transport costs:	-\$21,000	-\$17,000	-\$11,000
electricity and consumables	-\$3,000	-\$2,000	-\$1,000
ash dumping costs:	-\$120	-\$450	-\$720
additional staffing costs:	-\$30,000 (1/2 person-year)	-\$15,000 (1/2 person-year)	\$0
<b>total annual O&amp;M costs:</b>	<b>-\$63,120 per yr.</b>	<b>-\$41,450 per yr.</b>	<b>-\$17,720 per yr.</b>
<b>Economic Performance Indicators:</b>	<b><u>worst case scenario</u></b>	<b><u>probable scenario</u></b>	<b><u>best case scenario</u></b>
gas savings:	\$46,000 per year	\$103,000 per year	\$194,000 per year
Gross savings (incl. O&M, excl. capital costs)	-\$17,120 per year	\$61,550 per year	\$176,280 per year
Net earnings (incl. O&M and capital costs): <sup>3</sup>	-\$114,120 per year	\$7,550 per year	\$153,280 per year
Simple payback period:	never	6.6 years	1.9 years

<sup>3</sup> assuming depreciation period and interest rate as mentioned above

\* BDT: bone dry metric tonne

Yellow highlighted cells are input data - needs to be verified/checked