

ENERGY AND CARBON TAX COSTS BASED ON RATES AS OF OCTOBER 31, 2018		Total Energy Consumption (GJ)	Total Cost (\$/a)	Heating System Consumption			Total Fuel Consumption (from H2K)						
				Heating Energy (MJ for oil and gas; kWh for electricity)	Fan Energy (MJ for oil and gas; kWh for electricity)	Total (GJ)	Heating System Cost (\$/a)	Electricity (kWh)	N.Gas (m ³)	Renewable N.Gas (m ³)	Oil (L)	Total CO ₂ e (kg/a)	Heating CO ₂ e (kg/a)
Electric Furnace	Energy-efficient upgraded older house	76.67	\$ 2,661.65	5,507.30	106.80	20.21	\$ 651.24	21,298.10	-	-	-	227.26	59.90
	Older house not upgraded	130.79	\$ 4,754.32	20,243.40	392.70	74.29	\$ 2,393.79	36,330.40	-	-	-	387.66	220.19
Oil Furnace	Energy-efficient upgraded older house	82.19	\$ 2,924.74	25,342.30	384.80	25.73	\$ 1,042.09	15,789.70	-	-	658.00	1,913.99	1,733.79
	Older house not upgraded	150.64	\$ 5,384.15	92,720.30	1,414.00	94.13	\$ 3,493.58	16,084.80	-	-	2,407.10	6,557.08	6,343.48
Heat Pump	Energy-efficient upgraded older house	64.79	\$ 2,202.24	2,009.70	305.40	8.33	\$ 268.55	17,996.60	-	-	-	192.03	24.70
	Older house not upgraded	85.97	\$ 3,021.15	7,113.50	1,075.90	29.48	\$ 949.97	23,879.50	-	-	-	254.80	87.38
Electric Baseboard	Energy-efficient upgraded older house	76.47	\$ 2,653.77	5,556.90	-	20.00	\$ 644.60	21,240.30	-	-	-	226.64	59.29
	Older house not upgraded	130.28	\$ 4,734.79	20,494.80	-	73.78	\$ 2,377.40	36,190.10	-	-	-	386.16	218.69
NG Furnace	Energy-efficient upgraded older house	77.72	\$ 2,222.62	20,869.70	384.60	21.25	\$ 339.96	15,789.60	560.10	-	-	1,253.65	1,041.91
	Older house not upgraded	133.49	\$ 2,736.12	75,585.80	1,413.80	77.00	\$ 845.56	16,084.70	2,028.70	-	-	4,102.13	3,773.65
NG Furnace (with Renewable Natural Gas)	Energy-efficient upgraded older house	77.72	\$ 2,369.76	20,869.70	384.60	21.25	\$ 487.11	15,789.60	-	560.10	-	174.79	7.19
	Older house not upgraded	133.49	\$ 3,269.01	75,585.80	1,413.80	77.00	\$ 1,378.45	16,084.70	-	2,028.70	-	194.49	26.11
NG Furnace (\$50/tonne carbon tax, ~\$2.4935 per GJ)	Energy-efficient upgraded older house	77.72	\$ 2,238.34	20,869.70	384.60	21.25	\$ 355.69	15,789.60	560.10	-	-	1,253.65	1,041.91
	Older house not upgraded	133.49	\$ 2,793.13	75,585.80	1,413.80	77.00	\$ 902.58	16,084.70	2,028.70	-	-	4,102.13	3,773.65

Last Updated: March 21, 2018 by City Green Solutions for District of Saanich

Sources/Assumptions

Utility rates are for Saanich/Victoria area

The above analysis was completed based on the same house using Natural Resources Canada (NRCAN) HOT2000 Energy Simulation Software

Energy-efficient upgraded: insulated walls above grade/attic; uninsulated walls below grade; energy efficient windows

Not upgraded: uninsulated walls above and below grade, moderately insulated attic; single-glazed windows

For Renewable Natural Gas scenario, assume the home is using 100% renewable natural gas.

Includes estimated 3% increase to BCH rates on April 1 2018, and Carbon Tax increase from \$1.4898 per GJ to \$1.7381 per GJ

2016/2017 BC Best Practices Methodology for Quantifying Greenhouse Gas Emissions:

Energy conversion factor for heating oil = 0.03880 GJ/L	0.0388
Energy conversion factor for natural gas = 0.03885 GJ/m ³	0.03885
Energy conversion factor for renewable natural gas = 0.03885 GJ/m ³	0.03885
Energy conversion factor for electricity = 1GJ/277.78kWh	277.78
Emission factor (CO ₂ e kg/ GJ) for electricity = 2.964	2.964
Emission factor (CO ₂ e kg/ GJ) for oil = 68.37	68.37
Emission factor (CO ₂ e kg/ GJ) for renewable natural gas = 0.29	0.29
Emission factor (CO ₂ e kg/ GJ) for natural gas = 49.87	49.87

Fuel Costs	Cost	Monthly Charge
Oil (per L)	\$ 1.3826	\$ 10.00
Electricity (per kWh)	\$ 0.1160	\$ 6.08
N.Gas (per GJ)	\$ 8.6334	\$ 12.28
Renewable N.Gas (GJ)	\$ 15.6827	\$ 12.28

NG furnace = 95% AFUE

Oil furnace = 83% AFUE

HP = 7.4 HSPF

Cost Savings Analysis

Oil to Heat Pump

	Oil Costs	Heat Pump Costs	Dollars saved per year	% costs saved per year
Inefficient envelope	\$ 3,494	\$ 950	\$ 2,544	-73%
Upgraded Envelope	\$ 1,042	\$ 269	\$ 774	-74%

2016/2017 BC Best Practices Methodology for Quantifying Greenhouse Gas Emissions

Table 1: Stationary Fuel Combustion

(1) Fuel Type	(2) Energy Conversion Factor	(3) Bio CO ₂	Emission Factor (kg/ GJ)			(7) CO _{2e}
			(4) CO ₂	(5) CH ₄	(6) N ₂ O	
Natural Gas	0.03885 GJ/ m ³	–	49.58	0.0010	0.0009	49.87
Propane	0.02531 GJ/ L	–	59.86	0.0009	0.0043	61.15
Light Fuel Oil	0.03880 GJ/ L	2.77	68.12	0.0007	0.0008	68.37
Heavy Fuel Oil	0.04250 GJ/L	–	74.26	0.0013	0.0015	74.74
Kerosene	0.03768 GJ/ L	–	67.94	0.0007	0.0008	68.20
Diesel Fuel	0.03830 GJ/ L	2.77	67.43	0.0035	0.0104	70.62
Marine Diesel	0.03830 GJ/L	2.77	67.43	0.0039	0.0287	76.08
Gasoline	0.03500 GJ/ L	3.22	62.86	0.0771	0.0014	65.22
Wood Fuel – Industrial (50% moisture)	0.00900 GJ/ kg	93.33	–	0.0100	0.0067	2.24
Wood Fuel – Residential (0% moisture)	0.01800 GJ/ kg	94.22	–	0.8333	0.0089	23.48
Ethanol (E100)	0.02342 GJ/L	64.43	–	^a	^a	^a
Biodiesel (B100)	0.03567 GJ/L	69.36	–	^b	^b	^b
Renewable Natural Gas	0.03885 GJ/ m ³	49.58	–	0.0010	0.0009	0.29

^a Gasoline CH₄ and N₂O emission factors (by mode and technology) are used for ethanol.

^b Diesel CH₄ and N₂O emission factors (by mode and technology) are used for biodiesel.