



Minnesota Home Heating Consumption: a Look at Alternative Solutions



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Abstract:

Currently in Minnesota, 21% of all energy consumption is within the residential sector. Of that 21%, 41% of all energy goes towards home heating. In 2012, Minnesota used 411.575 million cubic feet of natural gas, which is equivalent to 423.922 billion British thermal units (BTU) or 68.735 million tons of carbon dioxide. This is an unnecessary and unsustainable amount of energy being used to heat our homes that could be greatly reduced. What are the possible alternative fuels that currently exist? There are many viable alternative fuels available to homeowners that show great potential. These alternative fuel sources include nonrenewable fuels, such as propane and heating oil, renewable fuels such as biomass including wood, pellets, and corn also solar and geothermal. Each of these fuels will be compared and contrasted against one another in order to find which alternative fuel source is not only the most economical but also the most sustainable.

Methods:

First, the current problem was identified, we are currently using too much natural gas to heat our homes when alternative fuels are viable. Next, research was done to evaluate various alternative fuel sources, and establish which ones were most viable. Each alternative fuel was simulated in an average Minneapolis home; looking specifically at heat output, cost and efficiency. Assuming each home was up to code on insulation and building materials. These alternative fuel sources were compared and contrasted against one another. This information can then be used to estimate the price a homeowner might pay if they currently were using an alternative fuel source.

2012	*Heating season from November to March										
	Home #1 2800 Sq Feet										
	Total Therms	Heat Therms	\$/Therm Nat Gas	Monthly Heat Cost	Monthly Cord Heat Cost	Monthly Pellet Heat Cost	Monthly Brick Heat Cost	Monthly Corn Heat Cost	Monthly Heating Oil	Monthly Electrical	Monthly Propane
November	60	13.86	0.88	12.20	77.6	22.18	23.06	15.61	36.72	49.61	31.57
December	107	60.86	0.76	46.25	340.8	97.38	101.27	68.55	161.25	217.88	138.66
January	146	99.86	0.74	73.90	559.2	159.76	166.16	112.48	264.58	357.51	227.51
February	152	105.86	0.72	76.22	592.8	169.37	176.15	119.24	280.48	378.99	241.18
March	138	91.86	0.70	64.30	514.4	146.97	152.85	103.47	243.38	328.87	209.29
Non-Heating Avg		46.14									
Heating Avg		120.60									
Year Heating Cost				290.18	2211.20	631.77	657.04	444.77	1046.21	1413.67	899.64

	CO2 Emissions
Cord Wood	115 kg
Pellet	115 kg
Briquettes	115 kg
Corn	48 kg
Heating Oil	73.16 kg
Electricity	135.6 kg
Propane	63.1 kg
Natural Gas	53.06 kg
	*Emissions per MBTU

What an average Minneapolis home heating bill would look like during the heating season if an alternative fuel was being used.

Without Efficiency								
	Cord Wood	Pellet	Briquettes	Corn	Heating Oil	Electricity	Propane	Nat Gas
Price Heat Output	\$200 per Cord	\$200 per ton	\$260 per ton	\$158 per ton	\$4.04	\$.12 per kWh	\$1.62 per Gal	\$.75/ Therm
MBTU	26.4	16	20	18	7.21 Gallons	293 kWh/mbtu	11 Gallon	100,000 Therm
Therm	264	160	200	180	1.38 per Gallon	30 kWh/therm	1.1 per Gallon	1 MBTU
\$ Per MBTU	\$7.57	\$12.50	\$13.00	\$8.80	\$29.13	\$35.10	\$17.80	\$7.54
\$ per Therm	\$0.75	\$1.25	\$1.30	\$0.88	\$2.91	\$3.51	\$1.78	\$0.75
With Efficiency								
	Cord Wood	Pellet	Briquettes	Corn	Heating Oil	Electricity	Propane	Nat Gas
Price Heat Output	\$200 per Cord	\$200 per ton	\$260 per ton	\$158 per ton	\$4.04 per Gal	\$.12 per kWh	\$1.62 per Gal	\$0.75
MBTU	2.64	12.48	15.6	14.04	9.22 Gallons	298 kWh/mbtu	14 Gallon	118,000 Therm
Therm	26.4	124.8	156	140	1.76 Gallons	30.6 kWh/therm	1.4 per Gallon	1.18 MBTU
\$ Per MBTU	\$75.57	\$16.02	\$16.66	\$11.25	\$37.24	\$35.76	\$22.68	\$8.89
\$ per Therm	\$7.57	\$1.60	\$1.66	\$1.12	\$3.72	\$3.57	\$2.68	\$0.88

Conclusion:

After reviewing viable alternative fuel sources, natural gas remains cheapest option. In order for alternative fuels to be cheaper per Therm, natural gas must go above \$1.12 for corn, \$1.60 for pellets, \$1.66 for wood briquettes, \$2.68 for propane, \$3.57 for electricity, \$3.72 for heating oil, and \$7.57 for cord wood. Not only is it possible that the price of natural gas goes up, but also alternative heating systems increase in efficiency which would also result in cheaper fuel. Even though natural gas is the cheapest, it is not the most sustainable. For example it only takes about four months to grow corn compared to millions of years for natural gas to form. Natural Gas may work in the short run, but as it becomes more popular the price will rise and the supply will diminish, resulting in a move toward alternative fuels.