Comparing the Cost of Heating Fuels – Using Conversion Data– Neme Reb Exh. A

Type of Energy	BTU/unit	Typ Effic	$/unit	$/MMBtu		High Efficiency	$/MMBtu
Fuel Oil, gallon	138,200	80%	$2.68	$24.23		95%	$20.41
Kerosene, gallon	136,600	80%	$3.23	$29.53			
Propane, gallon	91,600	80%	$2.64	$36.04		93%	$31.00
Natural Gas, therm	100,000	80%	$1.44	$18.01		95%	$15.17[b]
Electricity, kWh (resistive heat)	3,412	100%	$0.15	$43.46			
Electricity, kWh (cold climate heat pump)	3,412		$0.15			~~240~~ **270%**[a]	~~$18.32~~**16.28**[b]
Wood, cord (green)	22,000,000	60%	$ 227.14	$17.21	*		
Pellets, ton	16,400,000	80%	$294.00	$22.41	*		
AVERAGE OIL/PROPANE to GAS CONVERSION	100,000		$1.44			**88%**[c]	**$16.41**

* The natural gas price is based on the rate effective 2/5/15. *Wood green and Pellets updated 9/19/14.

This table is the table from page 3 of Hopkins Exhibit A, modified to use the equipment efficiency data from Hopkins Exhibit C for (1) cold climate heat pumps; (2) conversions from oil/propane to gas in which the existing oil/propane heating equipment is retained (using conversion burners); and (3) for conversions from oil/propane to gas in which a new efficient gas heating system is installed. A weighted average oil/propane to gas equipment efficiency is computed using Dr. Hopkins estimates of the portion of oil/propane to gas conversions that would be via conversion burners (61%) and the portion that would be from installation of new gas heating systems (39%). (Hopkins Appendix C, p. 10) All modified areas are highlighted in yellow. Note that efficiency values are rounded to the nearest 1 percentage point. Costs per MMBtu are based on actual (unrounded) efficiency values.

a. 270% is the mid-point found in the meta-study of cold climate heat pump efficiency cited by both Dr. Hopkins in Exhibit C (p. 12) and by Mr. Neme in his report. A New Hampshire study managed by Mr. Neme estimated average efficiency to be 280%.[1] A recent Maine evaluation study found an average heating season efficiency of over 300%.[2] Thus, the mid-point in the range in the meta-study appears consistent with climates similar to Vermont's.
b. This assumes 270% efficiency, holding constant the other values used by Dr. Hopkins.
c. 88% is a weighted average of existing units with an average efficiency of 85% and new gas heating systems with an average efficiency of 92% (Dr. Hopkins Exhibit C, p. 12). 61% of the conversions are assumed to be conversion burners; 39% are assumed to be new gas heating equipment installations (Dr. Hopkins Exhibit C, p. 10)
d. This assumes a weighted average efficiency of 88%, holding constant the other values used by Dr. Hopkins.

[1] http://www.neep.org/primary-research-ductless-mini-split-heat-pumps-0
[2] http://www.emiconsulting.com/assets/Emera-Maine-Heat-Pump-Final-Report-2014.09.30.pdf