Carbon Cost Estimator Methodology

The Carbon and Cost Estimator generates annual impacts using a couple of key factors about your house, current energy costs, and several assumptions based on the Vermont heating season and energy sources. The Estimator models the hourly energy needs for a home with the given parameters over a year of typical weather data. It then selects an appropriately sized heat pump to model the capacity and coefficient of performance (COP) as a function of outdoor temperature. For the hours where outside temperature is above the chosen swapover point, the cost and CO_2 emissions for running that heat pump are calculated; for the remaining hours, the cost and CO_2 of running a gas furnace are calculated, factoring in the selected percentage of renewable natural gas.

Your actual cost and carbon impacts may vary from these results, due to factors including:

- Home sizes are based on ranges of square footages and typical performance for weatherized and un-weatherized homes; if you home is at the high or low end of the size range selected, or if its insulation performance is exceptionally good or bad, this estimate may be inaccurate. This also applies to the estimated combustion efficiency of the gas furnace used in this model. See the table below for details.
- The Estimator assumes the use of high-performance cold-climate heat pumps that maintain their performance and capacity at low temperatures (see details below). The installation of less-performant heat pumps will result in less CO_2 savings and higher operating costs. More information about heat pump performance can be found at https://ashp.neep.org/
- Calculations are based on a “typical meteorological year” (TMY3) data from NOAA, which is intended to simulate average, low, and high temperatures based on historical data from 1980-2010. This data is intended to model the average annual heating load over the lifetime of a heat pump in the Burlington, VT area. Individual future years may have weather that induces more or less heating demand, and homes in other locations may experience different weather.
- The “carbon” savings estimates include greenhouse gas emissions in CO_2-equivalent tons, which normalizes by global warming potential. These factors were calculated based on publicly available data about the electricity supply portfolio of local utilities (after accounting for renewable energy credit trading), as well as VGS’ current renewable natural gas portfolio.

Carbon Cost Estimator Inputs and Assumptions

Typical home energy consumption parameters

Condition	Size label	Square feet	CCF per year
weatherized	small	1,250	501
weatherized	medium	2,000	694
weatherized	large	3,000	1,148
un-weatherized	small	1,250	695
un-weatherized	medium	2,000	953
un-weatherized	large	3,000	1,396

Home heating system parameters

Gas furnace efficiency	90%
Annual heating degree-days	4,141
Heating balance point	55°F

Heat pump models

(click links for performance specs)

3-ton	Ecoer Smart Inverter (ESI) Series Outdoor Unit Model #: EODA18H-4860B Indoor Model #: GNC3036BPT
5-ton	GE Appliances Connect Outdoor Unit Model #: AUH4860ZGDA* Indoor Model #: UUY48ZGDAB*

Fuel costs and CO_2e emissions

Electricity cost per kWh	$0.18
Natural gas cost per CCF	$1.25
Renewable natural gas cost-adder per CCF	$1.22
Electricity CO_2 lbs per kWh	0.034
Natural gas CO_2 lbs per CCF	12
Renewable natural gas CO_2 lbs per CCF	0