

Impacts of Heating with Biofuels

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Comparing the Cost of Heating Fuels

Types of Energy	Btu/unit	% Eff.	\$/ unit	\$/MMBtu
Fuel Oil, gallon	138,200	80	\$3.78	\$34.19
Kerosene, gallon	136,600	80	\$4.21	\$38.52
Propane, gallon	91,600	80	\$3.25	\$44.35
Natural Gas, therm	100,000	80	\$1.67	\$20.88
Electricity, kWh	3,412	100	\$0.15	\$43.96
Wood, Face Cord (12% Moisture)	20,000,000	60	\$65.00	\$5.42
Pellets, ton	16,400,000	80	\$247.00	\$18.83

Why Heat with Biofuels

- In the North Country, large percentage of home and building are older than 1970.
- Many of these need energy and weatherization done to save money.
- Forced Air systems in old homes.
- People opt for what they can afford.

Systems

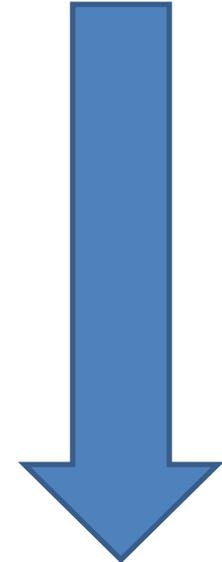


The Problem is Emissions

- Outdoor wood boilers
- Wood furnaces and boilers
- Fuel oil furnaces and boilers
- Natural gas furnaces and boilers

High

Low



Smoke

- Wood combustion appliances should allow dry wood to be burned by allowing enough air to flow over the greatest amount of surface area.
- White smoke is mostly steam indicating an efficient fire.
- Gray/ black smoke releases more chemicals due to inefficient combustion.

Fine Particulate Matter

- PM 2.5
 - Short term health effects
 - Eye, nose, throat, and lung irritation, coughing, sneezing, runny nose, and shortness of breath
 - Studies have linked PM 2.5 emissions to increased rate of bronchitis, reduced lung function, and an increased cancer risk.

The Bad Stuff

Waste/construction wood biomass combustion emissions

- Carbon Monoxide
- Hydrogen Chloride
- Hydrogen Cyanide
- Benzene
- Styrene
- Formaldehyde
- Arsenic
- Lead
- Chromium
- Benzopyrene
- Dioxins
- Furans
- PCBs

Forested wood biomass

- Carbon Monoxide
- Carbon Dioxide
- Arsenic
- Dioxins
- Furans
- Polycyclic Aromatic Hydrocarbons (PAHs)

Carbon Monoxide

Silent Killer

- Cord Wood 750 to 1500 ppm
- Wood Pellets 150 to 300 ppm
- Grass Pellets 1500 to 15000 ppm

Code Issues

- Chimney (Natural Draft)
 - In old masonry chimney, draft is important
 - Sizing of chimney for new furnaces and boilers
- Direct Venting
 - Sealed combustion (air in and exhaust out)
 - Higher efficiency

Sizing of Systems

- Heat Load Calculation (a must)
- Knowing the air exchange rate of a building should influence the selection and sizing
- It is good to get professional help. Rules of thumbs are not helpful for the homeowner.
- Ducts are wrong sized 90% of the time.
- Boilers need to have the right radiant systems in place.
- Additions to building space over many years not accounted for.

Homeowner

- A Sale on Pellet stoves. This must be a good brand! We can save money!
- How many tons do we need?
 - It depends on how it is used.
 - 1500 sq.ft. home with 42000 Btu/ hr at peak design conditions will require 4 – 5 tons for a season.

A Happy Customer

- “I’m comfortable for the first time.”
- “The difference this has made is that we’re warm. Saving money is great, but being warm, that’s the really great thing!”
- We’re saving some serious money over what we were paying for propane. And the best thing is that we’re warm!”