

Greenhouse Gas Emissions of Wood Pellet Heat

IN THE NORTHERN FOREST



Oct. 17, 2016

Analysis shows wood pellet fuel reduces greenhouse gas by 54% vs. oil, and 59% vs. natural gas

The Northern Forest Center commissioned a study of the greenhouse gas impacts of heating buildings with state-of-the-art wood pellet boilers. For the analysis, the Spatial Informatics Group-Natural Assets Laboratory (SIG-NAL) used data specific to the region's forest composition and harvest practices, and the pellet sourcing and manufacturing of 9 out of 10 Northern Forest pellet mills, all of which produce pellets exclusively for thermal (heat) generation. The life-cycle analysis shows:

- **On day one, using wood pellets for heat in the Northern Forest reduces greenhouse gas emissions by more than 50% compared to oil and natural gas.**
- **After 50 years, greenhouse gas emissions from pellets drop to 62% less than oil, 67% less than natural gas, and 56% less than propane.**

About this Study

SIG-NAL analyzed the greenhouse gas impacts of using modern wood heat in the Northern Forest using a forest sector life-cycle assessment tool and data not previously available.

Important Factors

SIG-NAL accounted for the following important factors in its analysis:

- The mix of energy sources used in pellet production at 9 of 10 mills in the region;
- Wood pellet composition, because the ratio of sawdust and mill residuals to low-grade wood affects the greenhouse gas impact of pellets (see page 2);
- Harvest levels. The results described in this summary are based on forest harvesting at 2015 levels, with the assumption that increased demand for pellet fiber is offset by reductions in other markets (see page 2) for no net increase in harvesting;
- Tree regrowth; and
- Forest dynamics and natural impacts that can affect unharvested trees and result in release of stored carbon.

Measuring the greenhouse gas impact of any heating fuel requires accounting for all emissions in production and use of the fuel, including:

- All the greenhouse gases associated with producing the fuel (including extraction or harvesting, manufacturing or processing, transportation);
- Greenhouse gases emitted by the fuel when used;
- Efficiency of the heat generation system being used; and
- Carbon stocks in the forest such as live and dead trees (in the case of using wood).

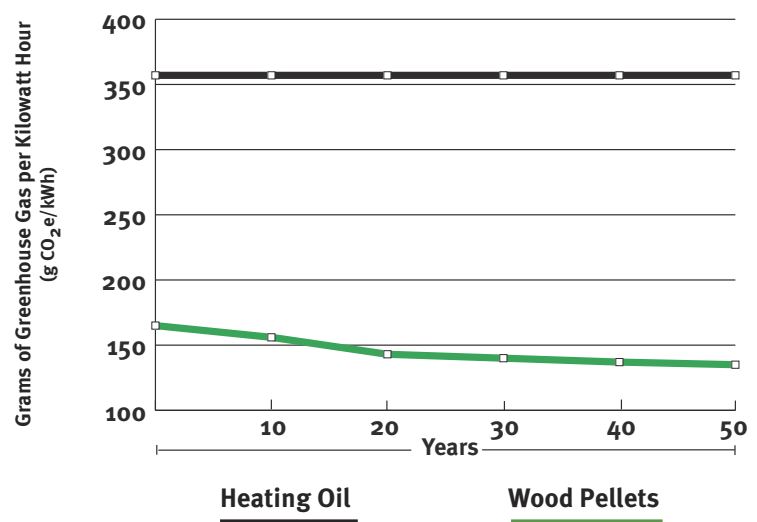
SIG-NAL used US Forest Service forest inventory data to define forest types and age classes for 2 representative wood supply areas within a 50 mile radius of the pellet plant, and used growth and yield projections from the Northeast Variant of the US Forest Service Forest Vegetation Simulator (FVS-NE) to examine the results of forest management options. SIG-NAL derived initial stand type and tree lists from Maine FIA plot data, which due to similarities across the Northern Forest, provided a reasonable estimation of growth response to management at the landscape scale. SIG-NAL used a new pellet life cycle assessment module for the ForGATE Forest Sector Greenhouse Gas Assessments Tool for Maine¹ to calculate total emissions for scenarios with and without pellet mills. (*Hennigar, C., L. Amos-Binks, R. Cameron, J.S. Gunn, D.A. MacLean, and M. Twery. 2013. ForGATE - A Forest-sector GHG Assessment Tool for Maine: Calibration and Overview. Gen. Tech. Rep. NRS-116. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 54 p.)

Full methodology is available at <http://nfccenter.org/2eiOr7U>.

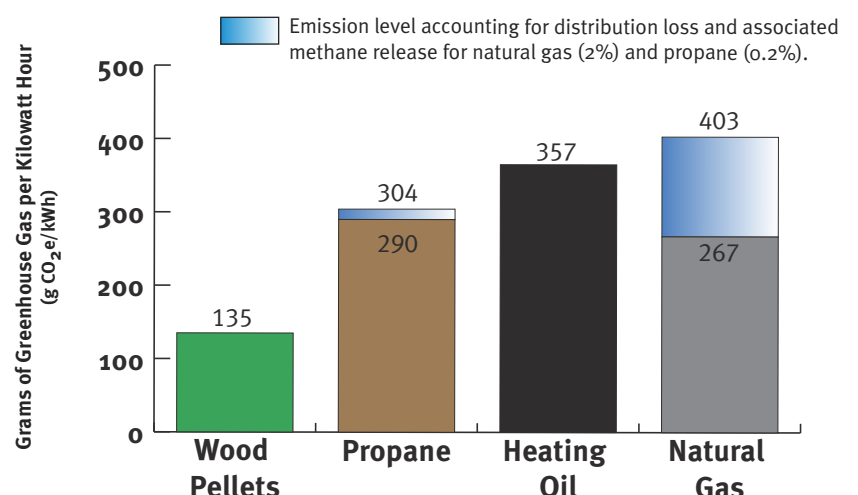
NET EMISSIONS COMPARISON—NORTHERN FOREST

Life-cycle emissions by fuel type, over time

- **Heating with oil produces 357 grams of greenhouse gas/kilowatt hour without reduction over time.**
- **Heating with pellets produces 165 grams/kilowatt hour initially and drops to 135 grams/kilowatt hour by year 50.**



- **At the 50-year mark, using wood pellets in modern pellet heating systems cuts greenhouse gas impact by 62% compared to oil; 67% vs. natural gas, and 56% vs. propane (based on 2015 harvesting levels and pellet composition).**



The Northern Forest Context

Almost half of pellet content gleaned from other uses

In 2015, the average Northern Forest-produced wood pellet was comprised of:

- 44% sawdust and other byproducts of forest product manufacturing—wood that was cut for other purposes;
- 56% low-quality pulpwood and small trees, usually the byproduct of harvesting for higher value timber;
- Less than 1% from other sources, such as landscaping and municipalities.



44%
mill residuals
and sawdust



56%
pulpwood and
other low-grade
wood

(Less than 1%
from other sources)

BEYOND THE STUDY: FOREST AND MARKET CONTEXT FOR PELLET MANUFACTURING

Changing markets make room for pellet production

Forests—and changing markets—provide the opportunity to reduce greenhouse gas impacts by heating with local, renewable wood pellets instead of fossil fuels.

Market changes

Across the Northern Forest, major traditional markets for low-grade wood, such as paper making, continue to shrink, creating an opportunity to shift pulpwood toward pellet manufacturing.

- Eleven pulp mills have closed in the Northern Forest since 1999, reducing demand for low-grade pulpwood.
- Between Oct. 2013 and April 2016, Maine lost 4 million tons, or 36%, of its low-grade wood market. Most of this reduction is not reflected on harvest volume graph at right.

Landowners rely on markets for low-grade wood that is harvested to improve long-term timber production, recreation and more. Pellets are an important part of the low-grade wood market. Steady markets for low-grade wood help landowners maintain forestland instead of converting it to non-forest uses such as development.

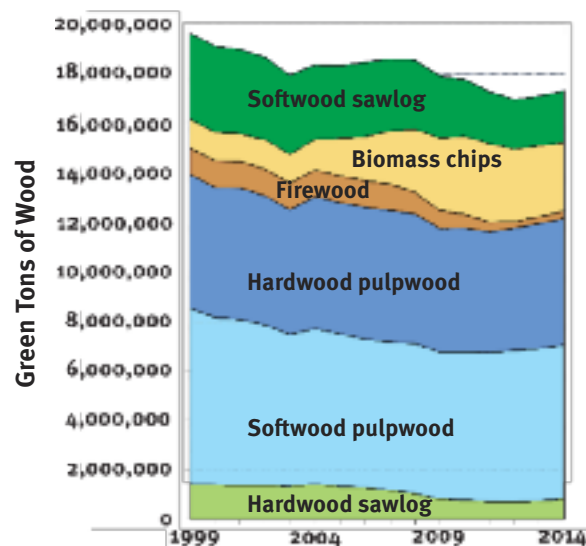
Forest volume context

An analysis of 2015 forest inventory data shows that the live volume of timber in forests in Maine, New Hampshire, New York, and Vermont is increasing. Annual forest net growth exceeds annual harvest.

- Net Growth: 21.6 million cords annually.
- Harvest: 12.6 million cords annually.

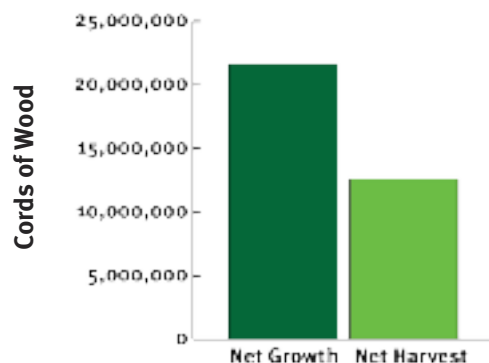
To see the economic benefits of using local wood pellets for heating fuel, visit www.northernforest.org/programs/modern-wood-heat/dashboard-regional.

MAINE HARVEST 1999 - 2014: Volume distribution by product (Green tons; 5-year trailing average)



Extracted from data provided by the Maine Forest Service

FOREST GROWTH vs. HARVEST: ME, NH, VT & NY 2015



2015 US Forest Service Forest Inventory Analysis data provided by the Maine Forest Service

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 Funding: **USDA Rural Development**

Other Credits:

Pellet Data: Nine Northern Forest pellet manufacturers provided data on wood sourcing and pellet composition.

Mill residual photo: Eric Kingsley, courtesy of Innovative Natural Resource Solutions (INRS)

Forest and market data: Maine Forest Service