Clean Heat Standard Technical Advisory Group – Wood Heat/Fuel Subgroup Meeting

Tuesday, November 5, 2024, 11:00-1:00 pm ET

Meeting Link: Zoom link: https://cbi-org.zoom.us/j/89637405423

DRAFT AGENDA

- Discuss issues surrounding wood heat/fuel in the program. Discuss ANR's wood fuel memo and TAG members' advanced wood heat memo.

Clean Heat Standard – Wood Fuel Carbon Intensities/Emission Factors and Other Issues

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October 30, 2024

This issue briefing has been prepared in response to the question posed by the Clean Heat Standard Technical Advisory Group (TAG), "What is the appropriate methodology for evaluating the greenhouse emissions and determining of credit values for wood biofuels and advanced wood heat?" and other related issues that have been raised around wood fuels. For ease of reading, this memo is divided into 5 sections:

1. Vermont Greenhouse Gas Inventory and Forecast: Background, Methodology, and Biogenic CO2
2. Use of Global Warming Potential Biogenic (GWPbio) and the Biogenic Carbon Footprint Calculator for Wood Fuels
3. Installed Measure Characterization and Advanced Wood Heating
4. Carbon Intensity Threshold & Emissions Tables
5. Northeast States for Coordinated Air Use Management (NESCAUM) Emissions Factors

Act 18 of 2022, the Affordable Heat Act, establishes the Clean Heat Standard. §8127 (c) states that "clean heat credits shall be based on the accurate and verifiable CO2e emission reductions in Vermont's thermal sector that result from the delivery of eligible clean heat measures to existing or new end-use customer locations into or in Vermont." §8127(g) states that emission rates for heating fuels "shall be based on transparent, verifiable, and accurate emissions accounting adapting the Argonne National Laboratory GREET model, Intergovernmental Panel on Climate Change (IPCC) modeling, or an alternative of comparable analytical rigor to fit the Vermont thermal sector."

1. Vermont Greenhouse Gas Inventory and Forecast: Background, Methodology, and Biogenic CO2

The Vermont Greenhouse Gas Emissions Inventory and Forecast reports (the Inventory) are required by 10 V.S.A. §5823. The Inventory estimates historic 1990 and 2005 baseline anthropogenic greenhouse gas (GHG) emission levels and tracks changes in those emissions over time to determine progress toward meeting the state's GHG reduction requirements in 10 V.S.A. §5784, which were updated with the passage of the Global Warming Solutions Act (GWSA) (Act 153) in 2020.

The Inventory uses a methodology that is consistent with the Intergovernmental Panel on Climate Change (IPCC) guidelines for governmental greenhouse gas accounting. Emissions totals in the Inventory are reported on a gross basis for the seven economic sectors with emission reduction requirements in the GWSA: agriculture, electricity, industrial processes, fossil fuel industries, residential/commercial/industrial, transportation, and waste. Sequestration of carbon dioxide (CO2) from the atmosphere is not accounted for in these individual economic sectors.

Emissions of biogenic CO2 related to the combustion or decomposition of biologically based materials are accounted for in the net flux (transfer from one pool to another over time) of carbon within the Land Use, Land Use Change, and Forestry (LULUCF) sector. While the Inventory includes estimates of biogenic CO2 emissions for several economic sectors (including from wood used for energy) for informational purposes, these emissions are excluded from the sector totals in accordance with the IPCC guidelines and the EPA accounting

framework for biogenic CO2 emissions.[1] The 2024[2] Inventory report notes that "how to appropriately account for biogenic CO2 is not an easy question to answer given the complexity of the systems involved and there is currently no consensus even within scientific literature as to the best approach."

2. Use of Global Warming Potential Biogenic (GWPbio) and the Biogenic Carbon Footprint Calculator for Wood Fuels

Global Warming Potential Biogenic (GWPbio) has been proposed as an indicator of the net potential warming impact of CO2 released by the combustion of biomass, taking into account how the regrowth of harvested biomass recaptures the CO2 released by combustion.[3] The 2024 Inventory report describes the use of GWPbio and the Biogenic Carbon Footprint Calculator (the Calculator), developed by the World Wildlife Fund and Quantis,[4] as "one additional framework for understanding emissions from biogenic carbon dioxide *that could be explored in more detail* which acknowledges that CO2 emissions from the combustion of wood are real and impactful while providing some credit for the renewability of the resource" (*emphasis added*). As the 2024 Inventory report notes, the use of GWPbio is one possible method, but there are no commonly accepted methods to account for biogenic CO2 emissions and removals in a life cycle assessment framework.

In the Approach to Lifecycle Analysis for Wood Products memorandum dated October 9, 2024, the Public Utility Commission's (PUC) contractor Opinion Dynamics (OD) proposed revisions to its assumptions for estimating the lifecycle emissions of wood fuels used for heating. OD uses these assumptions as inputs to the Calculator to estimate the GWPbio for the three wood fuel products evaluated (wood chips, wood pellets, and firewood).

For clarity, it is important to define some general terms used when discussing wood products and timber classification:[5, 6]

- Residue – a substance that is not the primary end product that a production process directly seeks to produce.
- Logging residue – the unused portions of trees cut or destroyed during logging operations and left in the woods.
- Mill residue – wood material from mills or other primary manufacturing plants that is not used for the mill's or plant's primary products. Examples are slabs, edgings, trimmings, miscuts, sawdust, shavings, veneer cores and clippings, and pulp screenings. Includes bark residues and wood residues (both coarse and fine materials) but excludes logging residues.

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[1] *Accounting Framework for Biogenic CO_2 Emissions from Stationary Sources*. US EPA, Office of Atmospheric Programs, 2011, https://www.epa.gov/sites/default/files/2016-08/documents/biogenic-co2-accounting-framework-report-sept-2011.pdf

[2] Vermont Agency of Natural Resources. *Vermont Greenhouse Gas Inventory and Forecast: 1990-2021*. State of Vermont, Agency of Natural Resources, 2024, https://climatechange.vermont.gov/climateactionoffice/greenhouse-gas-inventory

[3] Cherubini, Francesco, et al. "CO2 Emissions from Biomass Combustion for Bioenergy: Atmospheric Decay and Contribution to Global Warming." *GCB Bioenergy*, vol. 3, no. 5, 2011, pp. 413-26. https://doi.org/10.1111/j.1757-1707.2011.01102.x

[4] https://www.worldwildlife.org/projects/biogenic-carbon-footprint-calculator-for-harvested-wood-products

[5] *Forest Inventory and Analysis Glossary*. USDA, Forest Service, Forest Inventory and Analysis, 2023. https://research.fs.usda.gov/sites/default/files/2024-01/wo-fia_glossary_standardterms20231211.pdf

[6] Siol, Christoph, et al. "Utilizing Residual Biomasses from Agriculture and Forestry: Different Approaches to Set System Boundaries in Environmental and Economic Life-Cycle Assessments." *Biomass and Bioenergy*, vol. 174, 2023, https://doi.org/10.1016/j.biombioe.2023.106839.

- By-product – a residue that also satisfies the following conditions: (a) further use is certain, (b) can be used directly without further processing other than normal industrial practice, (c) is produced as an integral part of the production process, and (d) further use is lawful.
- Waste – a substance or object which the holder discards, intends to discard, or is required to discard.
- Pulpwood – roundwood, whole-tree chips, or wood residues that are used for the production of wood pulp.
- Sawtimber – a live tree of commercial species containing at least a 12' sawlog or two noncontiguous sawlogs 8' or longer and meeting regional specifications for freedom from defect. Softwoods must be at least 9.0" diameter at breast height (dbh). Hardwoods must be at least 11" dbh.
- Pole timber – For trees measured at breast height, softwoods 5.0-8.9" diameter and hardwoods 5.0-10.9" diameter.
- Bolt – a short piece of pulpwood; a short log.
- Roundwood – logs, bolts, or other round sections cut from trees.

Wood chips and pellets

In the draft Fuel Measure Characterization dated September 9, 2024, OD described its feedstock assumptions for wood fuels: "lumber mill wastes" for chips and a "blend of lumber wood, lumber mill residues, and lumber mill wastes" for pellets. Two points of feedback were provided to OD: (1) the inputs used in the Calculator to estimate GWPbio for wood chips did not reflect the assumptions in the September 9 document, and instead treated the feedstock as coming entirely from purpose-grown and harvested roundwood, and (2) wood pellets are primarily made from logging and mill residues.[7, 8]

In response to this feedback and additional questions, OD has proposed revising the feedstock assumption for pellets to residues (OD also uses the term lumber mill wastes) from the processing of roundwood into other merchantable wood products.[9] ANR agrees with this revised approach, which treats wood pellets and chips consistently.

Commercial firewood

In the Approach to Lifecycle Analysis for Wood Products memorandum dated October 9, 2024, OD also proposed revising its assumptions for the feedstock for commercial firewood. Using the most recent report on the economic contributions of Vermont's forest products sector,[10] OD determined that the feedstock is a 70%/7% ratio of hardwood (maple/beech/birch) and softwood (spruce/fir), resulting in a GWPbio factor of 0.75 for commercial firewood when the species ratio is normalized to 100% for two species available in the Calculator, cool temperate beech and pine. This new assumption raises two questions: (1) whether OD's use of purpose-grown and harvested feedstock inputs in the calculator is appropriate, and (2) whether the species mix/ratio chosen by OD is correct for firewood production.

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[7] Rodriguez Franco, Carlos. "Forest Biomass Potential for Wood Pellets Production in the United States of America for Exportation." *Biofuels*, vol. 13, no. 8, 2022, pp. 983-94, https://doi.org/10.1080.17597269.2022.2059951.
[8] Spelter, Henry, et al. *North America's Wood Pellet Sector*. USDA, Forest Service, Forest Products Laboratory, 2009, https://purl.fdip.gov/GPO/LPS126684.
[9] Opinion Dynamics memorandum "Approach to Lifecycle Analysis for Wood Products" dated October 9, 2024.
[10] Public Sector Consultants and Paul Frederick. *Forest Products Industries' Economic Contributions: Vermont*. Public Sector Consultants, 2020, https://fpr.vermont.gov/sites/fpr/files/documents/2017%20Forest%20and%20Wood%20Products%20Industries%20Economic%20Contributions.pdf

(1) Firewood feedstock: The majority of firewood is produced as a by-product of harvests that primarily produce higher value wood products.[11] Firewood is produced from small-diameter roundwood, branches, logging residues, and wood from lower economic value or lower quality species. Larger diameter, higher quality logs of commercial species are used to produce high-value wood products such as lumber, structural beams, furniture, and veneer. The non-sawlog portions of sawtimber trees and small-diameter roundwood from forest thinnings are used for the highest economic use that is locally available with market demand, either as pulpwood for the production of paper, paperboard, and packaging, or as fuelwood, with pulp markets generally being preferred. With the exception of firewood collected for personal use, there are significant economic and market barriers to harvesting forest biomass for fuel only, including the high cost of transportation, the low market value, low financial returns, and high cost of harvesting.[12]

(2) Species mix/ratio: The report cited by Opinion Dynamics is an economic analysis, not an inventory analysis. The hardwood/softwood ratio appears to have been determined from Exhibit 5, Forest Land Area by Forest Type Group (2017). This table reports forest composition by land area, not by volume. Forest Inventory & Analysis (FIA) data is available from the US Forest Service. We recommend that OD use Vermont-specific FIA data for this assessment. FPR is happy to facilitate access to FIA data upon request.

Should the TAG and OD move forward with the use of GWPbio for wood fuels, we recommend that the decision process to use it, and the evidence supporting that decision, be adequately explained in the technical and supporting documentation submitted to the PUC and/or used in the CHS. We also recommend that any use of the Calculator to estimate GWPbio factors be based on the available data for Vermont's forests, forest management, and wood utilization, and that any GWPbio estimates derived from the Calculator and used in the CHS be appropriately contextualized with respect to the limitations of the Calculator to account for Vermont-specific data.

3. Installed Measure Characterizations and Advanced Wood Heating

In the draft TRM Installed Measure Characterizations dated September 17, 2024, the following measures appear:

- 2.4.2/3.4.2 Advanced Wood Heating, Central Pellet Systems (Commercial/Industrial and Residential): The baseline is either a new central pellet system with a full load efficiency rating of 75% HHV or an existing wood heating system with a full load efficiency rating of 65% HHV.

- 2.4.3/3.4.3 Advanced Wood Heating, Pellet and Cordwood Stoves (Commercial/Industrial and Residential): The baseline is assumed to be an existing, less efficient wood stove supplementing an existing heating system.

Advanced wood heating systems are installed to replace various existing heating systems, including fossil fuel, electric, and wood systems.[13] The appropriate baseline condition for advanced wood heating systems should

[11] Goho, Curtis D., et al. *A Study of Logging Residue at Woods Landings in Appalachia*. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station, 1976.
[12] Nielson-Pincus, Max, et al. *Woody Biomass Utilization Trends, Barriers, and Strategies: A Survey of USDA Forest Service Managers*. Ecosystem Workforce Program, Institute for a Sustainable Environment, University of Oregon, 2012, https://digital.osl.state.or.us/islandora/object/osl%3A22736.
[13] VEIC, personal communication with Molly Willard, October 25, 2024.

be the same as the baseline condition for air source heat pumps. While the measure description for the air source heat pump states that it is replacing a fossil fuel system, option #1 for the baseline condition includes a mix of fossil fuels, electricity, and wood. In addition, we note that if the existing system is known and is not a fossil fuel system (e.g. electricity or wood), there is no algorithm for these fuels as a baseline.

In Version 2 (dated October 16, 2024) of the Definition of "Advanced Wood Heat" for the Clean Heat Standard document, the authors state that the Vermont Clean Energy Development Fund and Efficiency Vermont provide incentives to automated wood heating systems, a subset of advanced wood heating systems in the discussion and justification for the Option 1 definition of Advanced Wood Heat for the CHS. This is incorrect – incentives are provided for advanced wood heating systems, some automated and some not.[14] The 2022 Update: Advanced Wood Heat Sector in Vermont report[15] defines advanced wood heating as including "all wood fuels (cordwood, pellets, and chips) and all high-efficiency heating appliance (stoves, furnaces, and boilers) installed indoors." The 2022 Update report further states that advanced wood heating is generally representative of all new appliances incentivized by the State of Vermont programs.

We recommend that the TAG adopt a definition of Advanced Wood Heat that is consistent with existing programs. If the TAG decides to limit the definition of Advanced Wood Heat to automated systems, we recommend that the TAG does not also limit these automated systems to only pellet and chip systems. There are commercially available cordwood systems with automated and semi-automated operation.[16]

4. Carbon Intensity Threshold & Emissions Tables

10 V.S.A. §8123 defines carbon intensity value as "the amount of lifecycle greenhouse gas emissions per unit of energy of fuel expressed in grams of carbon dioxide equivalent per megajoule (gCO2e/MJ)." $8127(f) establishes a timeline with a declining carbon intensity value threshold for liquid or gaseous clean heat measures, where "…the carbon intensity values shall be understood relative to No. 2 fuel oil delivered into or in Vermont in 2023 having a carbon intensity value of 100. Carbon intensity values shall be measured based on fuel pathways."[17] §8127(g) establishes a schedule of lifecycle emission rates for heating fuels, any fuel that is used in a clean heat measure, and any fuel that is itself a clean heat measure.

Currently, the Technical Reference Manual (TRM) presents a single table that includes the carbon intensity values, the carbon intensity threshold timeline for liquid and gaseous fuels, and the lifecycle emission rate schedule. For clarity and public understanding, we recommend that the TRM include one table for liquid and gaseous fuels only with the proposed carbon intensity timeline from §8127(f) and a second table with the lifecycle emission rates from §8127(g).

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[14] "Available Rebates: Wood Heating." *Efficiency Vermont.* https://www.efficiencyvermont.com/rebates/list?cat=Heating%2C+Cooling+%26+Ventilation&hvacfilter=Wood+Heating&type=. Accessed October 29, 2024.
[15] Sherman, Adam, et al. *2022 Update: Advanced Wood Heat Sector in Vermont*. VEIC, 2024. https://publicservice.vermont.gov/sites/dps/files/documents/2022%20Update%20-%20Advanced%20Wood%20Heat%20Sector%20-%20Final%20Report%203.19.24_0.pdf
[16] "Firewood boilers and firewood heating systems." *Froling*. https://www.froeling.com/en-us/products/firewood-boiler/. Accessed October 29, 2024.
[17] 10 V.S.A. §8127(f)(3).

5. Northeast States for Coordinated Air Use Management (NESCAUM) Emission Factors

In their Draft Vermont Clean Heat Standard Lifecycle Emissions Rate Schedule dated August 29, 204, OD used combustion emission rates for CO2, CH4, and N2O from wood fuels from the US EPA Emission Factors Hub, with CO2 emission rates adjusted by a GWPbio factor as discussed above. In response, The NESCAUM shared "Criteria, Greenhouse Gas, and Hazardous Air Pollutant Emission Factors from Residential Cordwood and Pellet Stoves Using and Integrated Duty Cycle Test Protocol"[18] with the TAG and submitted the study as a comment to the record for the Clean Heat Standard. This study illustrates the variability in pollutant emissions, including greenhouse gases, that can occur depending on the heating appliance and the fuel type. While the emission factors for CO2 and CH4 are similar in the two approaches, they are not identical. It is unclear what alternative emission factors, if any, NESCAUM is proposing for consideration in this submission. A recommendation on this issue will require additional information on the rationale for considering an alternative.

[18] Traviss et al, "Criteria, Greenhouse Gas, and Hazardous Air Pollutant Emission Factors from Residential Cordwood and Pellet Stoves Using and Integrated Duty Cycle Test Protocol" accessed at https://epuc.vermont.gov/?q=downloadfile/735374/190907

Definition of "Advanced Wood Heat" for the Clean Heat Standard

Version 2 – October 16, 2024

Question for TAG Consideration:
How should "advanced wood heating" be defined for the purposes of determining which advanced wood heating installed measures are eligible clean heat measures under the Vermont Clean Heat Standard?

Option 1: Only fully automated, high-efficiency pellet and wood chip boilers and furnaces should be defined as "advanced wood heating" and considered eligible clean heat measures.

Option 2: All types of wood heating appliances (stoves, furnaces, and boilers) installed indoors **using all types of fuels (cordwood, pellets, and chips)** and meeting defined criteria for performance efficiency and air pollutant emissions should be defined as "advanced wood heating" and considered eligible clean heat measures.

Option 3: All types of wood heating appliances (stoves, furnaces, and boilers) installed indoors **using pellets and chips** and meeting defined criteria for performance efficiency and air pollutant emissions should be defined as "advanced wood heating" and considered eligible clean heat measures. Cordwood appliances should be excluded until such time as their emissions performance can be determined based on updated test methods.

Note: Proposed definitions and eligibility criteria are provided below, in the discussion of options.

Statutory Language
Act 18 includes "advanced wood heating" on a list of eligible clean heat measures. It also refers to advanced wood heating as one of several "installed clean heat measures" that require capital investments in homes and have measure lives of 10 years or more.

- 30 V.S.A. § 8127 (d) List of eligible measures. Eligible clean heat measures delivered to or installed in residential, commercial, and industrial buildings in Vermont shall include:
    - (7) advanced wood heating

- 30 V.S.A. § 8124 (d) (2) Of their annual requirement, each obligated party shall retire at least 16 percent from customers with low income and an additional 16 percent from customers with low or moderate income. For each of these groups, at least one-half of these credits shall be from installed clean heat measures that require capital investments in homes, have measure lives of 10 years or more, and are estimated by the Technical Advisory Group to lower annual energy bills. Examples shall include weatherization improvements and installation of heat pumps, heat pump water heaters, and advanced wood heating systems. The Commission may identify additional measures that qualify as installed measures.

Discussion of Options

Option 1: Fully automated, high-efficiency pellet and wood chip boilers and furnaces are eligible

Discussion: The VT Clean Energy Development Fund and Efficiency Vermont provide incentive payments to installers of automated heating systems that largely replace other, fossil-fueled whole-home heating systems. One possible definition of Advanced Wood Heat is to restrict eligibility to those automated systems that are designed as whole building heating systems.

The report, "2022 Update: Advanced Wood Heat Sector in Vermont" prepared by VEIC for the Vermont Department of Public Service Clean Energy Development Fund defines "automated wood heating" as "a subset of advanced wood heating that includes high-efficiency boilers and furnaces that are automatically fueled with either wood pellets or chips and can sustain automated operations for several days at a time." Notably, this definition excludes cordwood boilers and furnaces.

Proposed eligibility criteria under Option 1: Pellet and chip boilers and furnaces meeting the following criteria for efficiency and emissions would be eligible clean heat measures:

- Fully automated fuel feeding and bulk storage adequate for at least a week of continuous operation.
- Wood chip boilers and furnaces: Meets 80% HHV peak efficiency and less than 0.08 lbs per mmBtu PM2.5 (recognizing EPA or EN13240 test methods) and be classified as an indoor system and installed indoors.
- Pellet boilers and furnaces: Meets 85% HHV peak efficiency and less than 0.07 lbs per mmBtu PM2.5 (recognizing EPA or EN13240 test methods) and be classified as an indoor system and installed indoors.

The above criteria generally align with incentive eligibility requirements for these system types in Vermont incentive programs, including Efficiency Vermont and the Small Scale Renewable Energy Incentive Program (SSREIP).

Option 2: All types of wood heating appliances and fuels meeting defined efficiency and emissions criteria are eligible

Discussion: As another option, the term "Advanced Wood Heat" can have a broader definition. Emma Hanson, the former wood fuels coordinator at the Agency of Natural Resources communicated the following with respect to the range of wood heating options included as "Advanced Wood Heat" in the Clean Heat Standard: The whitepaper behind the Clean Heat Standard states, "Vermont has a long history of relying on wood for heat, and, more recently, significant experience in more efficient, lower-emitting advanced wood heat systems. Options today include efficient pellet stoves, automated pellet or chip boilers or furnaces, and efficient cordwood stoves."

For each category of appliance and fuel type, efficiency and fine particulate matter (PM2.5) emission criteria could be applied to distinguish between "best in class" and "run of the mill" appliances. The dividing line here is not to limit market choice of fuel (cordwood, pellets or chips) or appliance type (stove, boiler or furnace), but to set standards to encourage the market toward systems and fuels that have the best outcomes.

This approach is currently used for determination of eligibility for Efficiency Vermont rebates. Efficiency Vermont currently offers incentives for cordwood and pellet stoves and pellet boilers and furnaces in its residential program, as well as custom incentives for chip and pellet boilers installed in commercial buildings over 5,000 square feet. The efficiency and emissions eligibility criteria listed below align with Efficiency Vermont requirements.

Under Option 2, at least some of the stove installations that occurred after January 1, 2023, would be available for early action credits. Additionally, by including stoves as an eligible measure, this option allows for a clean heat measure that is more affordable and accessible to low- and moderate-income (LMI) Vermonters.

Proposed eligibility criteria under Option 2: Wood-burning appliances meeting the following criteria for efficiency and emissions would be eligible clean heat measures:

- Wood chip boilers and furnaces: Same as Option 1.
- Pellet boilers and furnaces: Same as Option 1.
- Cordwood boilers and furnaces: Meets 78% HHV peak efficiency and less than 0.08 lbs per mmBtu PM2.5 (recognizing EPA or EN13240 test methods) and be classified as an indoor system and be installed indoors.
- Cordwood stoves: Meets 75% HHV peak efficiency and less than 2.0 grams per hour PM2.5 (recognizing EPA or EN13240 test methods)
- Pellet stoves: Meets 75% HHV peak efficiency and less than 1.8 grams per hour PM2.5 (recognizing EPA or EN13240 test methods)

Option 3: Pellet and chip-burning appliances meeting defined efficiency and emissions criteria are eligible; cordwood appliances are not eligible until such time as their emissions performance can be determined based on updated test methods.

Option 2 would base eligibility for advanced wood heating measures on criteria for equipment efficiency and emissions performance. However, currently there is no reliable method to determine which cordwood stoves have acceptable levels of PM2.5 emissions. Additionally, there is no agreed-upon test method for cordwood whole home heating appliances and subsequently little research on their emissions to underpin a recommendation at this time. Therefore, Option 3 would specifically exclude cordwood appliances from eligibility as a clean heat measure.

Per a 2023 U.S. Environmental Protection Agency (EPA) Inspector General report assessing the effectiveness of EPA's residential wood heater program,[1] stove certification testing data under

[1] Available at https://www.epaoig.gov/sites/default/files/reports/2024-04/_epaoig_20230228-23-e-0012_2.pdf

EPA's program cannot be relied on to identify high-efficiency, low-emitting appliances. The EPA Inspector General report concluded that the federal program cannot be fixed without development of new and improved test methods along with a rule revision, stating that "state regulators and the public cannot rely on the EPA's wood heater program to ensure that only compliant appliances reach homes, and the EPA and states may be wasting millions of dollars on changeout programs by subsidizing new appliances that may not be substantially cleaner in real-world conditions." It also notes, "The EPA's 2015 New Source Performance Standards for residential wood heaters is flawed, and the EPA has approved methods that lack clarity and allow too much flexibility. As a result, certification tests may not be accurate, do not reflect real-world conditions, and may result in some wood heaters being certified for sale that emit too much particulate-matter pollution. In fact, data from an EPA-approved testing lab indicate that some certified wood heaters do not meet emission standards."

The largest concerns are around high PM emissions are for cordwood stoves. While certification data for all appliances is suspect, independent testing found pellet stove values are within an expected margin of error, based on Northeast States for Coordinated Air Use Management (NESCAUM) testing data published in the Journal of the Air & Waste Management Association.[2]

There is limited research on the emissions impacts for cordwood boilers and furnaces. According to the limited literature available, cordwood hydronic heaters had high emissions upon startup, but then were generally lower emitting compared to cordwood stoves. Overall, PM2.5 emissions are clearly higher than for pellet boilers and furnaces.[3] Cordwood appliance performance is also more dependent on wood quality and how the appliance is operated than appliances that use pellets or chips. Option 3 proposes to exclude all cordwood appliances, but potentially could be modified to exclude only cordwood stoves and allow cordwood boilers and furnaces.

Eligibility of cordwood appliances as a clean heat measure could be reevaluated in a few years, if and when an accepted testing method is widely applied that can more accurately determine the levels of PM2.5 emissions for these appliances. NESCAUM recently received a $9 million grant from EPA to test new wood-burning appliances and create an independent data set using new/improved test methods. NESCAUM is currently testing all types of wood heaters (central heaters and stoves, pellet and cordwood), but it will take several years and additional funds to get 300+ commercially available appliances tested. This dataset is intended to provide state, local, and Tribal agencies information to inform their efforts to address air pollution from residential wood heating while EPA works on new federal requirements (anticipated 2029-33 timeframe for rule implementation).

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[2] Available at https://doi.org/10.1080/10962247.2022.2056660)

[3] Lindberg, J., Vitillo, N., Wurth, M., Frank, B. P., Tang, S., LaDuke, G., … Butcher, T. (2022). Characterization of in-stack particulate emissions from residential wood hydronic heater appliances under different combustion conditions. *Journal of the Air & Waste Management Association*, *72*(7), 720–737. https://doi.org/10.1080/10962247.2022.2049398