**Wood Measures in TRM & Carbon Intensity of Wood**

***Draft – January 9, 2025***

**Questions for TAG Consideration**

1. How should Advanced Wood Heating measures be characterized in the Technical Reference Manual (TRM)?
2. What is the appropriate methodology for evaluating the greenhouse gas (GHG) emissions and calculating the carbon intensity for wood biofuels?

**Question 1: Issue Summary**

The first and second draft TRMs include four wood heat installed measures:

* Advanced Wood Heating – Central Pellet Systems (Commercial & Industrial)
* Advanced Wood Heating – Pellet and Cordwood Stoves (Commercial & Industrial)
* Advanced Wood Heating – Central Pellet Systems (Residential)
* Advanced Wood Heating – Pellet and Cordwood Stoves (Residential)

The TAG offers the following feedback to Opinion Dynamics regarding the characterization of wood measures in the TRM:

1. The TRM should be updated to match the TAG’s comments related to the definition of Advanced Wood Heating, to the extent feasible.
2. Measure characterizations for Advanced Wood Heating measures should not assume only wood-to-wood replacements. The majority of installations are likely to involve fuel switching from fossil fuel to wood. If site-specific information on the existing fuel is not available, the TRM could assume a blended baseline based on a representative mix of oil, natural gas, propane, electricity, and wood. We understand that Opinion Dynamics agrees with this approach.
3. Rather than separating out an installed measure and a fuel measure for wood-based systems, it makes more sense to lump them together so the fuel savings are folded into the measure characterization for Advanced Wood Heating installed measures. This would be similar to the approach for heat pump measures, in which the installed measure characterization accounts for the impact of fuel switching from fossil fuel to electricity. The TAG understands that Opinion Dynamics plans to use this approach.

**Question 2: Issue Summary**

As a first step to ensure a common understanding, the TAG confirmed that Opinion Dynamics used the following equation to calculate the lifecycle emissions rate for wood biofuels (as measured in grams of CO2 equivalent per megajoule (MJ)) in the TRM first and second drafts.

**Upstream Emissions + Combustion Emissions of CH4 & N20 +**

**[CO2 Combustion Emissions x GWPbio] = Lifecycle Emissions Rate (gCO2e/MJ)**

Determining an appropriate methodology for calculating the carbon intensity of wood therefore requires consideration of several different but related issues:

1. Assumptions for combustion emissions
2. Assumptions for upstream emissions, including the emissions from fuel processing
3. Assumptions for GWPbio, including the wood species used and whether the fuels are purpose-grown/harvested products or waste products
4. **Assumptions for combustion emissions**

In the draft TRM, Opinion Dynamics used combustion emissions rates for CO2, CH4, and N2O from the U.S. EPA Emission Factors Hub. The TAG did not have concerns with this approach.

1. **Assumptions for upstream emissions**

Opinion Dynamics used the GREET1 2023rev1 tool to calculate upstream emissions for wood biofuels. Upstream emissions for wood biofuels capture the emissions associated with steps in the lifecycle such as forest management, harvesting, lumber milling, fuel processing, and transporting the fuels to Vermont.

TAG members note that calculation of upstream emissions is sensitive to assumptions around the sourcing for wood biofuels (e.g., whether the fuels are purpose-grown/harvested products vs. waste products such as logging and mill residues). The Agency of Natural Resources (ANR) provided an issue briefing that offered detailed definitions for wood and timber products and residues, to ensure common terminology.[[1]](#footnote-1) ANR’s issue briefing also provided feedback that   
“wood pellets are primarily made from logging and mill residues.” If pellets are considered a waste product, then it would follow that the upstream emissions associated with forest management, harvesting, and lumber milling should be set to zero to reflect that these products are not driving these activities. Some TAG members questioned the characterization of pellets as primarily a waste product or harvest residue with zero upstream emissions.

The assumptions around whether wood fuels are waste products (logging and mill residues) should consistently apply to both GWPbio and upstream emissions. The issue of whether pellets should be considered waste/residue is therefore discussed further under “Issue C: Assumptions for GWPbio.”

1. **Assumptions for GWPbio**

For wood fuels, Opinion Dynamics “considered CO2 released in combustion to be part of a longer biogenic carbon cycle than biofuels, in which it takes significant time for the regrowth of new trees to fully sequester the biogenic carbon emitted during combustion.”[[2]](#footnote-2) Accordingly, they “applied a GWPbio factor to CO2 combustion emissions from wood fuels to account for the regrowth period of the fuel.” The higher the GWPbio, the higher the CO2 combustion emissions (e.g., the less emissions are discounted due to forest regrowth). Opinion Dynamics used the World Wildlife Fund (WWF) biogenic carbon footprint calculator to calculate GWPbio.

There are two supporting assumptions used by Opinion Dynamics that underpin calculation of GWPbio, both of which have been discussed by the TAG:

1. The WWF calculator relies on assumptions for the tree species in the forest where the wood fuels were sourced.
2. If the feedstock for wood biofuels is assumed to be 100% waste/residues, then none of the forest harvesting is due to the feedstock, and therefore, GWPbio will be set to zero. Therefore, like upstream emissions, GWPbio is sensitive to assumptions around the sourcing for wood biofuels (e.g., whether the fuels are purpose-grown/harvested products vs. waste products such as logging and mill residues).

On the first issue, tree species used in production of wood pellets, the TAG notes that the tree species assumptions should reflect the forests where the wood pellets are being sourced.[[3]](#footnote-3) Opinion Dynamics identified a report indicating 70% of VT forests are maple/beech/birch and 7% are spruce/fir, resulting in a GWPbio of 0.75. ANR’s issue brief raised several recommendations around the characterization of Vermont–sourced wood fuel to the extent it is used in the calculation of GWPbio for wood fuels.[[4]](#footnote-4)

TAG members also suggested that GWPbio requires different assumptions for tree species mixes for pellets not sourced from Vermont forests. The TAG has not identified reliable data on where pellets burned in Vermont are sourced. Anecdotal information (NESCAUM communication with VT DEC) suggests that there is only one pellet producer in Vermont and most of its production is sold out of state, while most pellets used in Vermont are imported. As a result, it is more appropriate, especially in the early years of implementation of Vermont’s credit system to reflect reasonable assumptions of forest species type for pellets sold in Vermont. Opinion Dynamics’ second draft TRM proposed to update the eligibility criteria for pellets to require that they be imported from North America rather than from “the northeast.” The TAG acknowledges that the pellet market is dynamic and will change over time and recommends that the wood species mix be determined based on the best available data or a close approximation of bulk and bagged pellet sales in Vermont and updated as more data becomes available.

On the second issue, the TAG has not reached an agreement on whether, and to what extent, pellets are sourced from mill waste and harvest management residues. TAG members have identified several sources that could be useful to review to inform this determination:

* Buckholz, Thomas et al. “Wood Pellet Heat from Northeastern US Forests.” *Energy*, vol. 141, December 15, 2017, pp. 483-491. <https://doi.org/10.1016/j.energy.2017.09.062>. Paper references “an industry-average feedstock mix consisting of equal parts of sawmill residues and pulpwood-quality wood.” The paper further details: “Based on the survey results, pellet mills in the region [Maine, New Hampshire, Vermont, and New York] fall into three categories of feedstock inputs: 1) 100% pulpwood and small diameter trees; 2) 100% sawmill residue; and 3) some combination of pulpwood/small diameter trees and sawmill residue. While individual facilities vary in terms of feedstock inputs, 55.7% of total feedstock consumption by the nine facilities came from forest harvesting operations, 43.8% from sawmill residues (primary and secondary), and 0.5% from other sources such as municipal waste and landscaping/yard trimming.
* 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://www.fs.usda.gov/research/publications/jrnl/wo_2022_rodriguez-franco_001.pdf>. This paper focuses on pellet production in the U.S. Southeast for export, noting, “wood pellets in the U.S. are mostly manufactured from forest residues or low-grade, low-quality logging and sawmill byproducts that would otherwise go to waste (i.e. tree tops and limbs, thinning treatments, mill residues such as sawdust or bark, low-quality wood).”
* Spelter, Henry et al. *North America’s Wood Pellet Sector*. USDA, Forest Service, Forest Products Laboratory, 2009, <https://doi.org/10.2737/FPL-RP-656>. This 2009 paper says, “Over two-thirds of the fiber used in pellet manufacturing was sawmill residues (Fig. 5). Other secondary wood manufacturing facilities, such as furniture and millwork factories, supplied 14% of fiber, reflecting the large share of pellet plants located in predominantly hardwood-growing regions where furniture activity is greatest. Sixteen percent was green material sourced from pulpwood or logging residues.” However, it also indicates that production of pellets using roundwood feedstock was growing as of 2009, noting “a number of new mills have been built to process chipped roundwood and have capacities three to four times as large.”

Not taken up in this document is the question of how to calculate the GWPbio for pellets sourced from mill, forest harvest residues, or harvest management practices. The TAG discussed these questions at length, but, as yet, has not come to broad shared understanding of the best approaches for doing so.

1. ANR, “Clean Heat Standard – Wood Fuel Carbon Intensities/Emission Factors and Other Issues,” October 30, 2024. [↑](#footnote-ref-1)
2. Opinion Dynamics, “Approach to Lifecycle Analysis for Wood Products,” October 9, 2024. [↑](#footnote-ref-2)
3. To the extent that they are part of the CHS program, wood chips and cordwood are likely to be sourced from Vermont forests. [↑](#footnote-ref-3)
4. [↑](#footnote-ref-4)