Questions from ANR Forestry Division (Katharine Servidio and Molly Willard), 18 September 2024, shared by Brian Woods

Opinion Dynamics responses, 2 October 2024

**Draft Vermont Clean Heat Standard Lifecycle Emissions Rate Schedule (Opinion Dynamics)**

1. How does this schedule relate to advanced wood heating systems as statutorily defined eligible measures in Act 18?

The schedule provides the CI for wood. The advanced wood heating system is an energy efficiency improvement measure in that the savings are derived from the more efficient wood stove over a baseline. Both the baseline and advanced stove use the same wood fuel, and subsequently carbon intensity.

2. What is the data source for the CO2 combustion emissions data? To what figure is the GWPbio factor applied? Table 1 does not provide this information, although the memo text implies that it is the US EPA Emission Factors Hub.

For combustion emissions we are utilizing the US EPA Emissions Factor Hub. The GWPbio factor is applied to combustion emissions of wood fuels. If it would be helpful to revise the text in the memo to clarify this point, we would be happy to do that.

3. Why are wood fuels treated differently than the biofuels, in particular landfill gas and animal waste biomethane which is not produced from short rotation crops, with respect to biogenic CO2 emissions?

For wood fuels we are applying a GWPbio factor to account for the temporal difference between the growth cycle of wood feedstocks, i.e., sequestration of carbon over many years, and the instantaneous carbon charge that is emitted at time of combustion. There is growing discussion in the scientific community that the assumption that biogenic carbon emissions are zero for biofuels, under the basis that sequestered carbon equals emitted carbon at combustion, is not sufficiently accounting for temporal differences between the carbon sequestration and carbon emission timeframes. It is of particular concern for certain wood fuels, which take decades to reach a prime age for harvest. Our use of the GWPbio factor is to account for that disparity. We apply it to wood fuels, because the growth cycle is magnitudes longer than crops used in biofuels.

4. What is the data source for upstream emissions of noncommercial firewood? The Vermont Energy Sector Life Cycle Assessment (LCA) does not provide this information (see Table 6).

We are recommending to remove this fuel pathway from the emissions schedule, in part because of a misunderstanding on our part as to what was meant by "non-commercial." We had assumed this was wood being used in the residential sector versus the commercial firewood fuel. We now understand that non-commercial wood was the intended to describe wood harvested through non-commercial means and which would therefore fall outside of any wood being delivered and the CHS.

5. Please explain how the Vermont Energy Sector LCA framework was applied to GREET1 2023 rev1 to generate upstream emissions for wood chips, wood pellets, and commercial firewood.

We received a copy of the ESLCA GREET1 2022 model and transcribed the updates into the GREET1 2023rev1 model. We reran the analysis for the 2019 year and compared results with the ESLCA, getting good fits (>95% matching range). From there, we revised the model to meet the needs of the CHS. For wood fuels, we maintained the assumptions in the ESLCA, e.g., moisture content, wood species, transportation distances.

**Draft Fuel Measure Characterizations (Opinion Dynamics)**

1. Please explain the rationale for using a GWPbio factor of 0.32, including the assumptions made for the feedstock species mix and product class.

We used the WWF biogenic carbon footprint calculator (<https://www.worldwildlife.org/projects/biogenic-carbon-footprint-calculator-for-harvested-wood-products>). We selected Cool Temperate | Spruce (Picea) and Cool Temperate | Pine all (Pinus) biomass sources at equal 50-50 shares.

2. In Section 1.2, Wood Fuels:

1. What is meant by the term “lumber wood”?

This was a poor choice of words. It is intended to represent wood logs/harvested wood. Use of "lumber" is confusing. GREET uses “roundwood” to describe timber. Would that term be more appropriate?

2. Does the firewood production pathway combine commercial and non-commercial firewood? Is kiln-dried firewood included?

These pathways are independent, but as discussed above, we are recommending that the non-commercial pathway be removed. From our review of the GREET model and the ESLCA modifications made for wood fuels, such as accounting for a wood species moisture content, it does not appear as though kiln-dried firewood is included.

3. Do any of the production pathways include logging residues as part of the feedstock?

Yes. Pellets are assumed to be produced from mill residues (shavings and sawdust), and chips are presumed to be waste chips from lumber mills. Some of our deliverable materials made misstatements about these production pathways; we will clarify those. Firewood is not assumed to be produced from residues.