MEMO

**To**: Deirdre Morris, VT PUC

**Fr:** TAG Subgroup on Opinion Dynamics’ Draft TRM

**RE**: Questions and Comments for OD

**Dt**: September 27, 2024

Opinion Dynamics responses, 11 October 2024

**INSTALLED MEASURES**

TAG subgroup members request that OD consider adding to Installed measures the following additional measures:

Broadly speaking, it is too late to add new measures at this late stage in the process. However, there may be an opportunity for the commercial HP clothes dryer modification. We offer comments on this item and the other suggested measures below.

* New construction - We caution against attempting to add residential or commercial new construction measures to the TRM. This is not a comment on the eligibility of new construction measures under the CHS or the value of such measures, but rather the complexity of the underlying calculations, which take into account multiple interactive end uses. This complexity makes a typical TRM characterization difficult. As a result, in energy efficiency, new construction projects are typically treated as custom measures and often require the use of energy modeling tools to estimate energy savings. We recommend a similar approach under the CHS.

We note that the Efficient and Electric Manufactured Homes measure is an exception to this practice. This new construction measure uses a simple prescriptive approach that we adapted from the existing Efficiency Vermont TRM characterization. However, a prescriptive approach is more feasible for Manufactured Homes than non-manufactured residential or commercial buildings, which have much greater variability in design and end use equipment.

* Wood stoves replacing fossil fuels – We decided not to create an installed measure for this scenario because it would be largely duplicative of the wood fuel measure characterization.
* Window heat pumps (e.g., for apartment buildings)[[1]](#footnote-1) - This technology seems worthy of inclusion as a clean heat measure.
* Comprehensive weatherization measure (WAP service type project) – The total savings of a comprehensive weatherization project can be approximated by combining the individual insulation, air sealing, HVAC, and domestic hot water measures in the TRM. We would caution against attempting to create a single comprehensive weatherization or WAP service measure in the TRM for the same reasons as discussed for new construction measures. This measure is better suited as a custom measure.
* Inside pools (commercial) – This could potentially be added to a future TRM version, but typically inside pool measures are treated as custom measure due to the complexity of the calculations and diversity of mechanical equipment types used with indoor pools.
* Liquid biofuel fired conversion of furnace or boiler (adaptation to existing appliance) We considered this scenario and decided to include it in the Biodiesel and Renewable Diesel fuel characterizations because the carbon reductions are ultimately achieved by fossil fuel displacement, not the retrofit itself.
* Commercial HP clothes dryers with electricity as a baseline condition We did not include this scenario or similar scenarios in the other clean heat measures because we felt it would not be consistent with the intent of Act 18, which is to target fossil fuel reductions rather than electricity reductions. However, if approved by the TAG and PUC, we could add this as a baseline option to the existing characterization relatively easily.

TAG subgroup members had the following questions regarding installed measures in the TRM:

* Are “wood stoves” referring to advanced pellet stoves? Noted that the codes and standards section references EPA-certified woodstoves, which some members believe is flawed.[[2]](#footnote-2) We included characterizations for both wood stoves, which include pellet and cordwood stoves, and central pellet systems. We understand from the October 3rd TAG meeting that there are concerns with the EPA’s certification standards for cordwood stoves in particular, and that the TAG is debating and may define a definition of “advanced wood heating” that may affect the eligibility criteria for these measures.
* How are we handling changes in federal codes and standards? E.g., If new HP efficiency standards are passed, how does that change the baseline or the deemed savings? Is it right to assume that all HPs installed after that point will meet the new standard? This is a common issue in TRMs. The short answer is they need regular updates to incorporate C&S changes. However, there is often a lag between when a standard takes effect and when it is implemented in the TRM. This has to do with how the timing and frequency of TRM updates, and how the standard is applied. For instance, federal appliance standards often are applied to the manufacture or import of new equipment; distributors can legally sell existing stocks of non-conforming equipment after the standard takes effect. As a result, TRMs may delay implementation of a new baseline to account for this “sell-through” period. Generally, the timing of baseline changes in TRMs is negotiated between regulatory agencies and stakeholders.
* Ductless air source and air to water heat pumps savings are different from current EVT TRM savings. EEU and Tier3 TRM will not change until 2025 or 2026, which will mean a mismatch in the near-term. How will this be handled? We understand that the equivalent full load hours (EFLH) for heat pumps we proposed in the TRM draft would, if approved, create a significant discrepancy in the underlying energy savings between the existing efficiency and Tier III programs and CHS. We can provide data and analysis but ultimately the regulatory agencies must decide this issue.
* Are the assumptions (e.g., eligibility criteria, measure life, and savings) aligned with EVT TRM? Many assumptions are. We used the EVT and Tier III TRMs as a starting points, but adjusted some assumptions where we felt there was sufficient reason to deviate. Note that we provided a list of parameter changes[[3]](#footnote-3) as part of the draft TRM delivery.
* Is the information required for tracking progress aligned with EVT and WAP programs? Our approach was to make recommendations rather than requirements for what parameters to track and to provide different options; for example, most measures have a baseline fuel mix option as well as fuel-specific baselines, and we also provide default values for use when a certain parameter will not be verified and tracked.
* Is there a heat pump option to replace rooftop fossil fuel thermal appliances? We assume this question is referring to single package heat pumps, which are also referred to as heat pump rooftop units. Both C/I air source heat pump measures support single package heat pumps in terms of the carbon impacts. However, we did not differentiate between split system and single package heat pumps in terms of measure cost. (See note on measure costs below).
* What will custom measures be used for?

We envision they would serve a similar purpose as in energy efficiency programs: allowing for site-specific measure calculations for any measures not in the TRM that meet the requirements of Act 18.

* + A member suggested that bespoke measures for mixed biofuels be avoided, and recommended using a more standardized approach for simplicity.
* RE: heat pump water heaters (HPWH)– Who determines whether a standard electricity water heater replaced by a HPWH will be considered as a credible measure? A member Identified inconsistency in the TRM approach.

We understand this question pertains to whether replacing standard electric equipment with heat pump equipment is valid under the CHS. As explained previously, we avoided including standard electric equipment as an eligible baseline technology in any measure. The insulation, air sealing, and ERV/HRV measures may be exceptions: they each allow for incumbent electric heating systems, either electric resistance or heat pumps. However, these measures do not replace the incumbent systems; they are thermal efficiency measures that act to reduce heating loads and thus electrical usage.

We did provide a mixed fuel baseline option for all measures except for the Advanced Wood Heating installed measures, which specifically address efficiency improvements in wood heating systems. The mixed fuel baseline option supports program implementation approaches where the baseline fuel is not tracked or verified. Electricity is included because it is part of Vermont’s heating fuel mix. The mixed fuel baseline option was discussed with the TAG following are our “Early Win” measure characterization deliverable.[[4]](#footnote-4)

* RE. Table 7: Average Heating Efficiency. A baseline efficiency for commercial and industrial electric clothes drying or elsewhere of 3.66 is too high and appears to assume a present heat pump adoption of 100%. Please explain. Table 7 lists the average (space) heating efficiency by fuel, not the dryer efficiency. As described in footnote 8, these figures were sourced from the 2021 Vermont Business Sector Market Characterization and Assessment Study. Figure 50 shows 0% penetration for electric resistance in VT Gas and non-VT Gas territories. (1% of Large buildings had electric resistance heating, but the percentage of all buildings with electric resistance heating statewide is apparently approximately 0%.) Figure 50 also suggests that water source heat pumps and split system heat pumps comprised all electric heating systems across these territories. The COP of 3.66 shown in TRM Table 7 is the weighted average of the heating system efficiencies for water source heat pumps (4.8) and split system heat pumps (2.9) recorded in the study.

Please refer to the “CI space heating fuels” tab in the supporting document “VT heating fuels mix 2024-09-18” for the derivation of the TRM Table 7 figures.[[5]](#footnote-5)

* For building thermal shell measures (i.e. air sealing and insulation) a baseline assumption of total air leakage or zero insulation is not appropriate. Mean building quality characteristics can be taken from the 2020 and 2021 market assessments. Use of either the median or one standard deviation below the median building quality would be more appropriate. See:
  + Commercial and industrial:
  + publicservice.vermont.gov/sites/dps/files/documents/VT Market Assessment
  + Report 2021 FINAL.pdf
  + Residential:
  + <https://publicservice.vermont.gov/sites/dps/files/documents/VT_2020_SF_EX_Baseline_Final_Report_Jan242023.pdf>

To be clear, the Air Sealing measure baseline is not total leakage; the baseline is a site-specific measured value. The characterization calculates site-specific CO2e reductions based on the difference in leakage measured before and after air sealing.

In the Building Shell Insulation measure, example CO2e reductions are provided in Table 14 assuming no insulation as a starting point. This table and other decarbonization summary tables should be considered examples and not deemed figures. They were provided at the behest of the PUC to provide decarbonization ranges for each measure. Site-specific pre- and post- R-values are the primary inputs to the Insulation measure.

That said, we can certainly change the example baseline R-values to values that are more representative of Vermont’s building stock. A median value may not be the best example, because the buildings that install insulation are likely to have below-median levels of existing insulation.

* How are costs determined?[[6]](#footnote-6) Measure costs were sourced from other TRMs and studies; no primary research was performed. Because many of the costs in the EVT and Tier III TRMs referenced local markets, we relied heavily on these sources. In general, measure costs are not the focus of our contract, so received less rigor than impacts-related parameters.

We are happy to review and incorporate the heat pump cost data from Emily Levin.

* Will the actual cost of a measure be reported or will it be tracked based on TRM cost estimates? This a question for program implementers and regulatory bodies.
* Have cost estimates based on historical costs been updated to reflect actual inflation rates No.

**DELIVERED FUELS – LIQUID & GASEOUS**

Subgroup members had the following questions on delivered fuels:

* RE. Program data tracking recs: A member suggested additional data be required, so that renewable attributes for fuels regulated under other programs is reported when delivered so ownership of the credit can be tracked.
  + The TAG is welcome to recommend additional data for tracking. In our draft TRM, we limited the data to the minimum information that is needed to implement a project. This is to minimize the burden of data tracking on the implementation team and participants. Excessive data tracking can have an unintended consequence of negatively impacting participation. However, more data enables greater insight to the types of projects and use of the TRM.

If the TAG wants to provide a list of items for tracking, we can review those items and provide thoughts on what makes sense to include or exclude.

* Is LUC treated consistently for wood and liquid fuels, i.e., is it either included or excluded for both?
  + This comment has been addressed in previous comments submitted by the TAG. We have attempted to remove LUC impacts for all alternative fuels measures. This was done to be consistent. However, the GREET models are large and complex workbooks. If in the TAG’s review, LUC impacts are found to have been incidentally included, we welcome the feedback and will address accordingly.
* Why is biodiesel CI from corn feedstock lower than from waste-based feedstock e.g. cooking oil?
  + Thank you for this comment. We took a deeper dive into the GREET models to identify sources of differences. We found that the carbon intensity of biodiesel from corn crops applied the default marginal allocation method, which allocates all emissions to ethanol except those associated with the process of corn oil extraction. As a result, the impacts associated with corn farming are fully associated with ethanol production. This is inconsistent with other fuels where a BTU-based or mass balance allocation method for emissions is applied for co-products. We will issue updated values as soon as possible.
* Please provide inputs and assumptions to GREET, e.g., screenshot of GREET input spreadsheets.
  + We have provided the full GREET models for the TAG’s review.
* Are T&D losses applied to liquid fuels going through pipelines or being delivered by trucks to reflect leakage or spills?[[7]](#footnote-7)
  + We are attempting to account for emissions associated with truck delivery, e.g., tailpipe emissions, as well as electricity line losses and natural gas pipeline leaks. The T&D values do not account for leakage from the delivery truck’s tank. If the TAG has information on the rate of leakage from delivery truck tanks, we will attempt to incorporate this into the TRM assumptions.

**DELIVERED FUELS – WOOD**

* Please explain Inconsistent treatment of wood biomass vs other biofuels made from waste products. If wood fuel is from waste feedstock, then the upstream production emissions should not be included.
  + Thank you for these comments. Please see a separate wood fuels memo with further responses to this comment.
* It appears that the OD is using .32 global warming potential (GWP) bio factor, which was included as an example in 2023 ANR inventory. A member noted that this value is not part of official 2023 inventory and was not referenced in 2024 inventory. This value should be reviewed if it is being used for wood biomass, including pellets or chips, particularly if the assumption is that these fuels come from waste.
  + Thank you for these comments. Please see a separate wood fuels memo with further responses to this comment.
* Is OD using purpose grown forests (not waste or white pine) rather than the calculator to estimate Cis for wood biomass fuel?
  + Thank you for these comments. Please see a separate wood fuelsmemo with further responses to this comment.
* What does the term “Lumber wood waste” mean? This is not a term used elsewhere.
  + As noted in previous comment responses, 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?

**DELIVERED FUELS – ELECTRICITY**

* How is “system average emission rates” used in the calculation of VT electricity CI?
  + We apply the distribution of electric grid resources (e.g., % wind, % solar, % natural gas) to the upstream and combustion carbon intensities calculated from the GREET model and referenced from the US EPA Emissions Factor Hub, respectively, to derive an aggregate system average *emission rate* (also referred to as *carbon intensity*).
* How was the 4% T&D adder for line losses developed and used? Other studies estimate electricity line losses to be between 9-18%.
  + This was an assumed value determined by our subject matter experts. However, line losses are regionally specific and the value we applied may not be representative of VT’s electric grid. We reviewed the previously referenced 2024 AESC study which uses an annual average line loss factor of 6%, and suggest revising to that value unless the TAG has a more specific suggestion (we note that the Commission has also shared with us the approved Vermont EEU cost-effectiveness screening values, which also contain line loss information, which we will review and incorporate if appropriate).
  + Additionally, we would also like to request that the TAG share any available information they may have on natural gas distribution system loss factors specific to Vermont. We similarly made assumptions for that loss factor which may not be representative of Vermont’s distribution system. Similar to the above, we note that the Commission has also shared with us the approved Vermont EEU cost-effectiveness screening values, which contain a discussion of avoided methane leakage. We will review and incorporate this information if appropriate.

1. From Gradient and Midea. See also attached short summary from a recent Building Decarbonization

   Coalition webinar. One notable aspect of this technology is its application to renters, since these units fit in a

   window, can be used in a small apartment, and can be taken with the renter if and when they move. NYC

   Housing Authority is currently doing a large pilot of these technologies as part of its Clean Heat for All

   Challenge. Emily Levin thinks EVT is also looking at this technology and perhaps developing a pilot, so they

   may be able to provide some insight. [↑](#footnote-ref-1)
2. Reference in TRM: "All new wood heating appliances offered for sale in the US are required to meet New

   Source Performance Standards (NSPS)[1] promulgated by the US EPA. The NSPS requires that appliances

   meet specified particulate matter emission limits, revised most recently in 2020. The NSPS does not

   prescribe minimum efficiencies but requires manufacturers to have the efficiency tested and certified by an

   accredited laboratory. The EPA maintains a certified wood heater database where certified emissions and

   efficiency values are listed by make and model.

   (https://cfpub.epa.gov/oarweb/woodstove/index.cfm?fuseaction=app.about)… [↑](#footnote-ref-2)
3. “VT Clean Heat Measures-Parameter Changes from VT TRMs\_2024-09-17” [↑](#footnote-ref-3)
4. See “TAG Responses to Opinion Dynamics’ Responses to TAG’s 8 July 2024 memo [Draft]” dated August 8, 2024. [↑](#footnote-ref-4)
5. Opinion Dynamics delivered supporting files to the PUC on September 20th. It is our understanding that the files are publicly available. [↑](#footnote-ref-5)
6. NESCAUM is currently developing a trove of data on installation costs for residential heat pump water

   heaters and air-source heat pumps that might be useful for OD to reference. The report, Heat Pump Water

   Heaters in the Northeast and Mid-Atlantic: Costs and Market Trends, is already published and NESCAUM will

   be publishing a similar report for HVAC heat pumps within the next few weeks. Emily Levin can share a draft if

   OD is interested in looking at preliminary cost data. [↑](#footnote-ref-6)
7. A member referenced the TRM: "Carbon intensity adders for delivery of fuels to end user and transmission

   and distribution loss factors are required to calculate carbon reductions from many measures in this

   document. Table 2 presents those values for reference." [↑](#footnote-ref-7)