

AGENDA

GHG inventory background (ANR)

Discussion: key GREET assumptions

Discussion: customizing GREET

BACKGROUND — GHG INVENTORY

Inventory of anthropogenic GHG emissions for Vermont - published annually

- Required by state statute (10 V.S.A. § 582)
- Total (gross) annual emissions by sector within the boundary of the state (electricity exception) - not including biogenic CO₂ in sector totals
- Relies in part on federal datasets and EPA tools and so lags several years behind the calendar year when the emissions occurred – current inventory 1990 – 2020 (1990 – 2021 in progress)
- Methodologies consistent with accepted GHG inventory standards/protocols
 - Final Vermont Greenhouse Gas Inventory and Reference Case Projections, 1990-2030 (2007) report, IPCC, EPA
- Current inventory uses 100-year global warming potential (GWP) values from the IPCC AR4 report
- Land-use, Land Use Change, and Forestry (LULUCF) sector included in the inventory which accounts for biogenic CO₂ fluxes and sequestration but not included in official Global Warming Solutions Act (GWSA) gross emissions requirements

VT GHG INVENTORY APPROACH VS. CHS LIFECYCLE EMISSIONS APPROACH

- Emission reduction requirements under Vermont's Clean Heat Standard (CHS) are based on and measured by the state's greenhouse gas (GHG) emissions inventory (10 V.S.A. § 578(a)).
 - The CHS law references the “thermal sector” which corresponds to the “Residential, Commercial and Industrial (RCI) Fuel Use” sector in GHG Inventory (minus offroad diesel)
- Emissions requirements for CHS are based on a lifecycle values but tied to non-lifecycle GHG Inventory estimates
 - GHG Inventory: Point of emission within the confines of Vermont (except for electricity)
 - Lifecycle analysis of greenhouse gas emissions: Includes emissions from all stages of production or use of a product (energy, fuel, commodity, etc.) within a defined system boundary (not limited to the state boundary)
- A Vermont Energy Sector Life Cycle Assessment was completed to supplement the existing GHG Inventory and to provide information about upstream emissions corresponding to the GHG Inventory sectors – provides upstream emission factors and emission estimates by energy pathway

DISCUSSION — KEY ASSUMPTIONS

Key assumptions in GREET:

- Avoided methane emissions
- Biogenic carbon dioxide emissions
- Methane leakage
- Avoided emissions from reduced electricity generation
- Others?

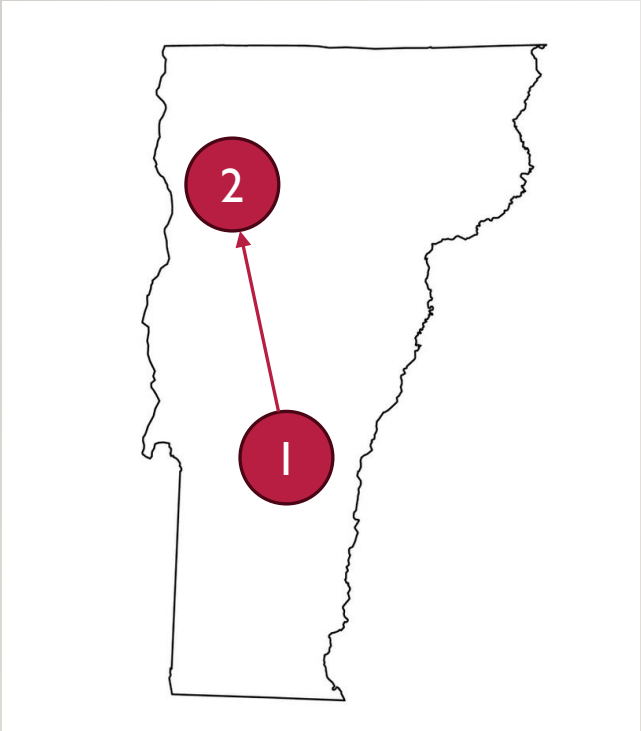
- What does GREET assume as a default?
- What did the Eastern Research Group (ERG) study for ANR assume?
- What other options might the TAG consider? (non-exhaustive)

What are the implications for:

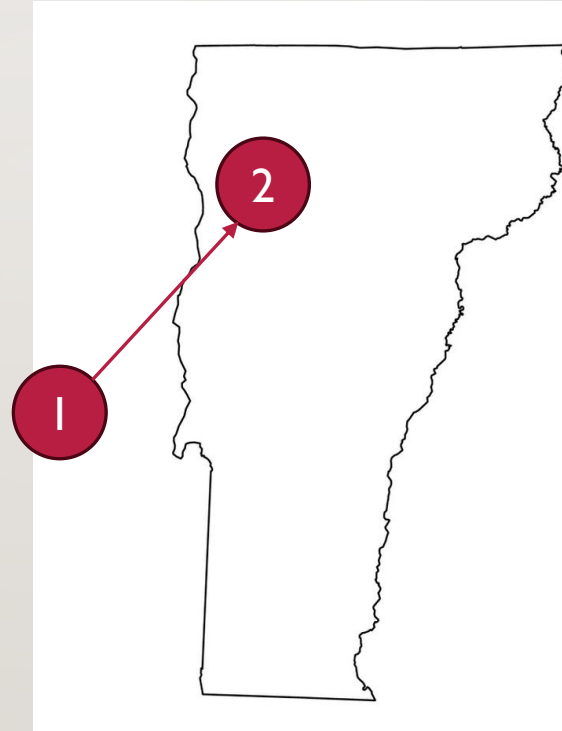
- Fully in-state pathways?
- Cross-border pathways?

IN-STATE VS. CROSS-BORDER FUEL PATHWAYS

Fully in-state pathway



Cross-border pathway



- 1** Feedstock
- 2** Combustion

Fuel pathway:

- Detailed description of all stages of a fuel's production and use, including feedstock generation or extraction, production, transportation, distribution, and combustion
- Used to calculate carbon intensity value and lifecycle GHG emissions of each fuel

AVOIDED METHANE EMISSIONS

Issue: Should renewable natural gas (RNG) be credited with lifecycle emission reductions for avoided methane emissions from landfill gas flaring and/or traditional manure treatment of animal waste?

- Default GREET: Full credit for avoided CH₄ emissions
- ERG/ANR study: No credit for avoided CH₄ emissions
- Other options: Partial credit for avoided CH₄ emissions
(but no negative carbon intensity scores)

What are the implications for:

- Fully in-state pathways?
- Cross-border pathways?



BIOGENIC CARBON DIOXIDE EMISSIONS

Issue: Should GHG emissions from burning biogenic fuels (wood, pellets, ethanol, biodiesel) be counted towards lifecycle emissions for those fuels, or should they be excluded because biomass emissions are accounted for the land-use, land use change, and forestry (LULUCF) sector of the VT GHG inventory, which includes changes in carbon stocks in land (forest, farms, wetlands, etc.)?

- Default GREET: Biogenic CO₂ emissions excluded
- ERG/ANR study: Results reported with and without biogenic CO₂ emissions
- Other options: Exclude biogenic CO₂ for in-state projects
+ include for out-of-state feedstocks

What are the implications for:

- Fully in-state pathways?
- Cross-border pathways?

METHANE LEAKAGE

Issue: What rate of methane leakage should be assumed when calculating the lifecycle GHG emissions for both fossil fuels and biofuels? This leakage occurs during production and transport in both fossil fuel and biofuel/RNG supply chains (associated with production and transport)?

- Default GREET: Modestly higher than U.S. EPA numbers
- ERG/ANR study: No change to default GREET assumption
- Other options: Update based on latest science (closer to 2-3% leakage than 1% leakage)
Update RNG leakage with pathway-specific data

What are the implications for:

- Fully in-state pathways?
- Cross-border pathways?

DISCUSSION — CUSTOMIZING GREET

- Should Vermont customize its own version of GREET?
- If so, through what procedural mechanism (e.g., PUC order)?
- If so, under what conditions or parameters?
 - Where should the approved version of GREET be hosted (e.g., on the PUC website)?
 - Should the approved version of GREET be further customizable by model users for individual projects or pathways?