Stockholm Environment Institute

Support for Vermont Agency of Natural Resources

Planned Updates to Baseline Scenario in Vermont LEAP Model

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Agenda

1. Refresher on model, model platform
2. Goals of planned work
3. Sector-by-sector overview of planned updates and input needs
4. Timeline, next steps

Providing feedback

- Interrupt for short clarifications, reserve longer questions for 15-minute discussion.
- Email us:
  - Taylor.Binnington@sei.org
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LEAP platform, Vermont applications

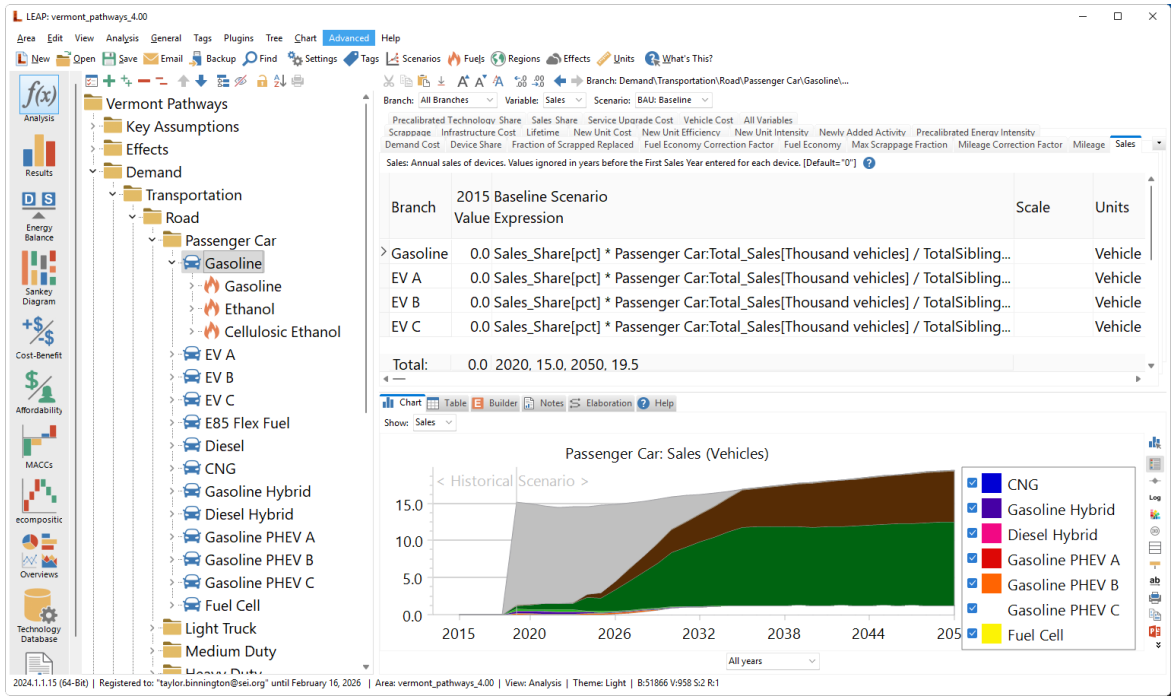
What is LEAP?

- Scenario-based modeling tool **(not a model)** for energy planning and greenhouse gas mitigation assessment developed by the Stockholm Environment Institute
- Thousands of *active* users in nearly every country:
  - Over 60 Nationally Determined Contributions to the Paris Agreement
  - New England: MA CECP and 2015 Update, RI GHG Reduction Plan, NY Genesee-FLX Climate Action Strategy

What is the VT LEAP Model?

- GHG emissions model for VT, developed using LEAP
- Models energy consumption and production in all sectors, associated GHGs, non-energy GHGs, costs of one scenario vs. another

The LEAP platform



Key point: what we get out depends on what we put in

- Foremost for energy system (and energy-related GHG) modeling
- Uses scenarios to explore logical outcomes of changes
- Scenarios share a common starting point, and alternative scenarios require us to answer the question “alternative to what?”
  - The “what” is usually a common reference scenario
  - For VT Pathways Model, we call this the Baseline Scenario

Vermont applications

- **2021:** Initial development of VT LEAP Model for VT Comprehensive Energy Plan (SEI, NESCAUM, Public Service Department)
- **Later in 2021:** Development of Central Mitigation Scenario for VT Climate Action Plan (Cadmus, EFG, ANR, SEI)
- **2022/2023:** Public Service Department-led work for Regional Planning Commissions (PSD, SEI)
- **2022/2023:** Marginal abatement cost analysis of individual actions within Central Mitigation Scenario (Cadmus, EFG, ANR, SEI)
- **2023:** Analysis of thermal sector policies (inc. partial model update) (EFG, SEI, ANR)

2025: Full model update for next CAP

Goals, in two streams:

Baseline Scenario Updates (now)

1. Update current or recently-available historical data that feed into Baseline Scenario
2. Align current/historical GHG emissions from all sectors with latest GHG inventory
3. Including non-energy GHGs from AFOLU, waste, IPPU
    a. Incorporate new trends or other forecasts
4. Make structural changes to improve transparency, general ease-of-use, ability to incorporate subsequent data updates, and ease of reporting

Mitigation Scenario Updates (after)

1. Updated mitigation measures and scenarios for the Climate Action Plan

Overview of proposed structural changes to model

Goal 1.4: Make structural changes to improve transparency, general ease-of-use, ability to incorporate subsequent data updates, and ease of reporting

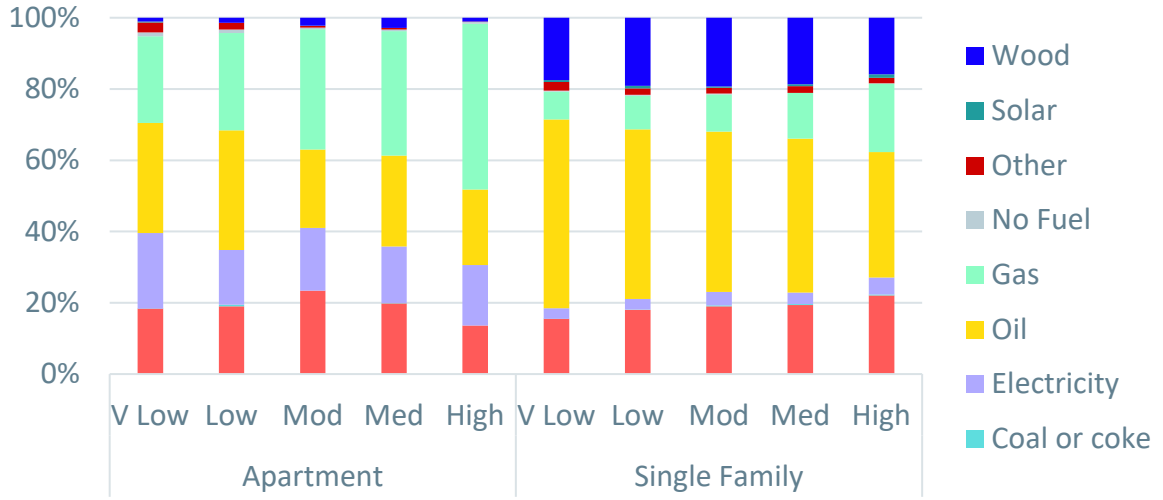
- Road transport: further disaggregate vehicle weight classes, while aggregating vehicle technologies
- Commercial buildings: align building shell definitions with residential buildings, improve energy use per unit floorspace estimates
- Add or improve built-in “indicators” to report quantities of interest, clean up old scenarios
- Other minor changes

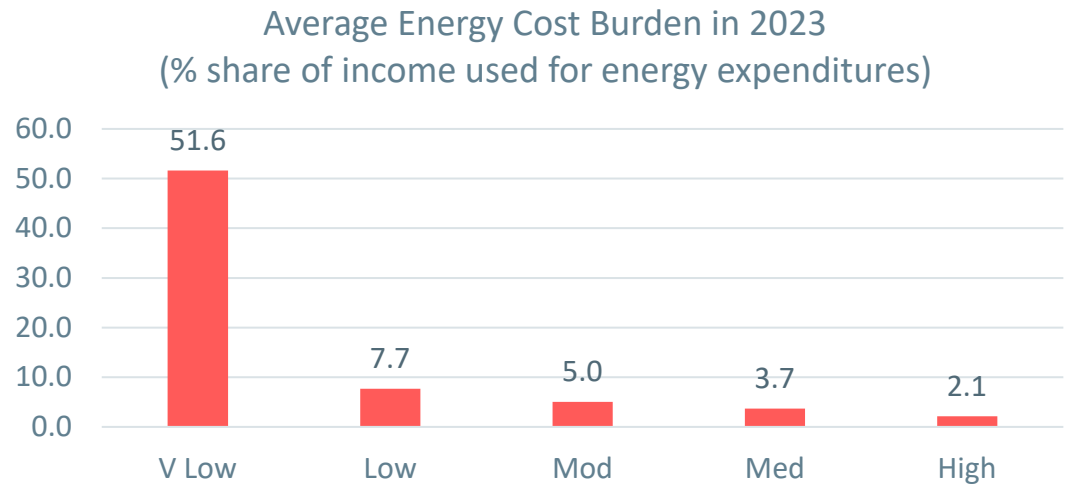
Overview of proposed structural changes (cont'd)

- Residential: arrange household categories to eliminate some unnecessary detail, while adding new disaggregation by income level

Better understand the degree of inequality in energy use

Enable analyses of targeted measures to specific household income groups and building types





Source: Preliminary SEI analysis of ACS 2023 data

Updates to data and forecast assumptions

Goals 1.1-1.3: Update model with new data, harmonize with GHG inventory, update trend assumptions

The following slides:

- Briefly introduce the model's representation (detail, methods) of each major emitting sector
- Briefly and non-exhaustively describe the types of historical data, assumptions and forward-looking assumptions or policy impacts for the Baseline Scenario that are needed

Input collection is already underway; inclusion of items in "data needs" may not imply it remains outstanding.

Updates to road transport data

Planned model representation

- Stock-turnover model of on-road vehicles
- Vehicles grouped approximately by weight class and drivetrain technology/fuel consumed

Inputs required for Baseline Scenario update:

- Bioethanol/biodiesel blending ratio (by volume) in transport gasoline/diesel
- Zero-emissions vehicle sales share among each, or groups of, vehicle weight classes (such as Class 1+2a)
- Current and historical vehicle stocks by technology and class
- Total vehicle sales by class
- Load shapes for EVs

Updates to other transport data

Planned model representation

- Top-down (total) fuel consumption per capita
- Rail, aviation, navigation, other (ex. pipeline) transport represented separately

Inputs required for Baseline Scenario update:

- Energy consumption by fuel for rail transport
- Energy consumption by fuel for aviation (excluding international)
- Energy consumption by fuel for navigation
- Energy consumption by fuel for other transport

Updates to residential buildings data

Planned model representation

- Bottom-up fuel consumption per household for each technology within most end-uses, including thermal end-uses
- Top-down fuel consumption per household for smaller end-uses
- Households disaggregated by type (apartments with 2-4/5+ units, single-family attached/detached, mobile), tenure (owned, rented), income level (very low, low, moderate, medium, high), shell type (existing, new, retrofit)

Inputs required for Baseline Scenario update:

- Energy consumption by fuel
- Technology shares for building categories represented in model (building type, tenure, shell type, income level)
- Device efficiencies and energy consumption characteristics for end-uses represented in model
- Load shapes for heat pumps and other electrified devices

Updates to commercial buildings data

Planned model representation

- Bottom-up fuel consumption per square foot for each technology within most end-uses, including thermal end-uses
- Top-down fuel consumption per square foot for smaller end-uses
- Commercial floorspace disaggregated by shell type (existing, new, retrofit)

Inputs required for Baseline Scenario update:

- Energy consumption by fuel
- Total floorspace for each model building category (shell type)
- Technology shares for building categories represented in model (shell type)
- Device efficiencies and energy consumption characteristics for end-uses represented in model, including data centers
- Load shapes for heat pumps and other electrified devices

Updates to industry data

Planned model representation

- Top-down (total) fuel consumption only, no subsectoral disaggregation

Inputs required for Baseline Scenario update:

- Biodiesel blending ratio (by volume) in industry
- Energy consumption by fuel

Updates to electricity consumption data

Planned model representation

- Least-cost capacity expansion and dispatch of major electricity generation and storage technologies
- VT-located plants and VT-contracted energy are separately represented, in principle allowing consumption- and production-based emissions accounting
- All capacity on ISO-NE grid is represented to provide estimate of “rest of system” electricity mix

Inputs required for Baseline Scenario update:

- Contracted energy purchases from each electricity generation technology, separately for generators located both within and outside of Vermont
- Contracted energy purchases from QC, NY and NB, and share of those purchases qualifying as renewable under VT Renewable Energy Standard
- Electricity generation or storage capacity by technology across ISO-NE

Updates to other cross-cutting data

Planned model representation

- The model relies on several exogenous inputs that may be used to influence multiple sectors

Inputs required for Baseline Scenario update:

- Heating and cooling degree-day forecast
- County-level population and forecast
- Gross state product
- Biodiesel blending ratio (by volume) in heating oil
- Biogas or renewable natural gas blending ratio (by volume) in distributed natural gas

Updates to non-energy GHG data

Planned model representation

- Exogenous emissions (both historical and forecasted) layered on top of energy-related GHGs
- Where basic emissions accounting from EPA's State Inventory Tool can easily be represented, reproduce that calculation within the LEAP interface
- LULUCF emissions likely determined outside model

Inputs required for Baseline Scenario update:

- Emissions by specific GHG (not just as CO2e) for industrial processes and product use (IPPU), and sub-sources
- Emissions by specific GHG (not just as CO2e) for agriculture, and sub-sources
- Emissions by specific GHG (not just as CO2e) for waste, and sub-sources
- Emissions by specific GHG (not just as CO2e) for land use, land-use change and forestry (LULUCF)

Timeline for Baseline Scenario updates

ASAP: SEI and ANR to finalize data and assumptions needs, continue collecting input and identify items not yet collected/no source identified

21 March: Residential and transport sector updates

4 April: Commercial, industrial, electricity, non-energy GHG updates

Mid-April – Update review with Science & Data (proposed)

Late March through April: Incorporate feedback and iterate on model

2 May: Updated model with final Baseline Scenario

Questions and feedback

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