Using MOVES2010 for Estimating On-Road GHG Emissions

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Overview of Presentation

- Introduction to MOVES2010
- Key Features of MOVES for GHG Estimation
Introduction: MOVES2010

- **Motor Vehicle Emission Simulator**
- Estimates total emissions & energy use from all on-road sources (cars, trucks, buses, motorcycles)
- Contains latest data about vehicle emissions
- Uses an updated software platform
  - Modular database structure is easier to update with new emissions, fleet, and activity data
  - Could eventually include other mobile sources (e.g., non-road, marine, locomotive, aviation sources)
MOVES and GHG Estimation

● EPA’s best tool for estimating on-road GHGs:
  - CO₂, N₂O, CH₄, and elemental carbon (black carbon)

● Key features that improve emissions estimates:
  - Allows distinct modeling of different operating modes
    ● Such as driving, vehicle start-up, idling
    ● Allows assessment of various strategies on GHGs
  - County and Project level scales allow on-road GHG estimation for various geographic areas
    ● Gives users ability to customize with local inputs
MOVES and Operating Modes

- MOVES improves emissions estimates by accounting for vehicle behavior through time.
- MOVES uses a distribution of time vehicles spend in different “operating modes” (bins):
  - Operating mode – what the vehicle is doing, i.e., accelerating, braking, cruising, idling.
  - Vehicles use different amounts of energy (“vehicle specific power” or VSP) in different operating modes.
  - MOVES defines 23 operating mode bins for running: combinations of speed and VSP.
  - Also includes additional operating modes for starts, extended idling, etc.
Distribution of Operating Time by Bin
Light-Duty Cars and Trucks

Rural Freeway
Urban Freeway
Rural Arterial
Urban Arterial

< 25 mph
25 - 50 mph
> 50 mph

Fraction of Operating Time
VSP (KW/tonne)
MOVES Emissions Rates:

- MOVES includes a different emissions rate for each combination of:
  - Source,
  - Age group, and
  - Operating mode

  - Gas-LDV-MY2001 8-9 years low speed coast; 20 mph, VSP 0-3 kW/tonne
  - Gas-LDT-MY2005 4-5 years accelerating; 55 mph, VSP 12-15 kW/tonne

- Information can be aggregated for total emissions
- National MOVES GHG estimates match GHG estimates based on fuel sales
National Fuel Consumption Comparison

![Graph showing national fuel consumption comparison between gasoline and diesel from 2000 to 2007. The graph compares tax data and final MOVES data, with gasoline consumption in blue and diesel consumption in green.](image-url)
MOVES Analysis Scales

MOVES has three possible scales of analysis

1. **National scale**
   - Uses default fleet and vehicle activity data within model
   - Not recommended for estimating emissions for a state or smaller geographic area; results will be inaccurate

2. **County scale**
   - Relies on user-supplied data

3. **Project scale**
   - Relies on user-supplied data

- Common emission rates for all three scales
County Scale

- Could be used to estimate GHG emissions for:
  - An individual county
  - Several counties and/or portions of counties
  - An entire state, using every county or using a representative county(-ies)

- Better resolution than national scale

- Could be used to examine GHG impacts of regional travel changes, if travel model sensitive to them, e.g:
  - Addition of public transit / commuter rail
  - Changes in traffic volumes, routes, and speeds
Project Scale

- Could be used to estimate GHG emissions from a specific highway or transit project

- Could be used to examine GHG impacts of changes that affect driving behavior on a specific facility, e.g:
  - Adding a lane to highway or arterial
  - Synchronizing traffic signals along an arterial
  - Adding or improving transit service on a route

- Requires user to bring information on how the change affects detailed vehicle driving patterns
CO₂ Impact of Traffic Smoothing

- Transient Driving
- Smooth Driving
Visit the MOVES website: www.epa.gov/otaq/models/moves/index.htm

Software, technical documentation, conference and meeting presentations, and other helpful background materials