Energy and Emissions Reduction Policy Analysis Tool

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Energy and Emissions Reduction Policy Analysis Tool

FHWA Developed EERPAT as a Decision Support Tool for Policy Analysis

- Mitigation Strategies
- Policy Evaluation
  - Land Use
  - Demographics
  - Vehicle Fleet Characteristics
  - Transportation Pricing

Provides new opportunities for GHG policy analysis:

- Policy evaluation tool for areas without travel demand models and/or emissions modeling experience
- Quick policy screening for areas that do use these models
EERPAT Background

- **Based on the GreenSTEP model**
  - GREENhouse gas Statewide Transportation Emissions Planning Model, developed by the Oregon Department of Transportation (ODOT) Transportation Planning Analysis Unit (TPAU)

- **FHWA funded project to make available to other states.**

- **EERPAT operates on a county level and has been used for statewide policy testing**
  - Could be used at the MPO level, although MPOs typically have more sophisticated travel models
  - ODOT is testing GreenSTEP at the MPO level

- **Tool Available:** [http://www.planning.dot.gov/FHWA_tool/](http://www.planning.dot.gov/FHWA_tool/)
  - Free Software-Built in the R statistical computing language
  - Documentation
  - Case Studies (Oregon and Florida)
# Model Sensitivities

## Land use and demographics
- Population demographics (age structure)
- Personal income
- Relative amounts of development occurring in metropolitan, urban and rural areas
- Metropolitan, other urban, and rural area densities
- Urban form in metropolitan areas (proportion of population living in mixed use areas)

## Transportation supply
- Amounts of metropolitan area transit service
- Metropolitan freeway and arterial supplies

## Vehicle fleet characteristics
- Auto and light truck proportions by year
- Average vehicle fuel economy by vehicle type and year
- Vehicle age distribution by vehicle type
- Electric vehicles (EVs), plug-in hybrid electric vehicles (PHEVs)
- Light-weight vehicles such as bicycles, electric bicycles, electric scooters, etc.

## Policies
- Pricing: fuel, vehicle miles traveled (VMT), parking
- Demand management – employer-based and individual marketing
- Car-sharing
- Effects of congestion on fuel economy
- Effects of incident management on fuel economy
- Vehicle operation and maintenance – eco-driving, low rolling resistance tires, speed limits
- Carbon intensity of fuels, including the well to wheels emissions, and production of power to run electric vehicles.
EERPAT: Model Structure

Generate synthetic households

Apply urban area land use and transportation system characteristics

Model vehicle ownership types and ages

Model initial estimates of household vehicle travel

Model household vehicle types and allocate VMT to vehicles

Calculate household cost per vehicle mile

Recalculate household vehicle travel and adjust allocation to vehicles

Aggregate characteristics by county, income group and development type

Model heavy vehicle VMT

Adjust MPG due to congestion

Calculate fuel consumption by type

Calculate lifecycle CO$_2$e emissions by fuel type
Data Inputs and Outputs

Demographic Inputs:
• Population forecasts by county, age to 2040
• PUMS household data from the American Community Survey
• Household income forecasts

Travel and Land Use Inputs:
• NHTS data on vehicle ownership by household type
• NHTS data on daily travel
• Transportation supply data,
• Land use (residential density)
• NHTS data on vehicle ages
• Urban Mobility Report: speed vs ADT per lane

Emissions Inputs:
• MOVES-based estimates of fuel economy
Consistency with EPA’s MOVES Model

- EERPAT is meant to be used in conjunction with MOVES, not as a replacement for MOVES.

- The EERPAT Users Guide explains how MOVES can be used to develop several EERPAT inputs:
  - Age Distribution
  - Auto, light truck, bus, and heavy truck fuel economy
  - Fuel parameters, fuel technology by vehicle type

- Some MOVES inputs can be developed or partially developed with EERPAT (for more refined GHG emissions analysis in MOVES):
  - Source Type Population
  - Age distributions for alternative scenarios
  - Vehicle Type VMT
  - Average Speed

- The Users Guide also discusses maintaining consistency between EERPAT and MOVES runs, so that the results of the two models are in reasonable agreement (if, for example, EERPAT is used to screen a large number of scenarios, and then the regional TDM and MOVES are used for refined analysis of a few).
Several rounds of scenario development and modeling

- **Round 1**: Broadly explore the territory to understand the possibilities, implications for meeting 2050 target.
- **Round 2**: Narrow down potential scenarios, make adjustments, examine trajectories for GHG reduction: look at 2020 and 2035 as well as 2050.
- **Round 3**: Further narrow/adjust scenarios. Evaluate and recommend leading candidate(s).

Objectives Scenario Testing

**Understand**:

- Magnitude of possible GHG emissions reductions
- Change needed to reduce GHG emissions by 75%
- Identify Pathways to get Oregon to the reduction goal
- Key factors/interactions for reducing GHG emissions
- Scenarios to carry to next round of modeling

- Modeled 144 combinations of levels of six policy groups: Urban Characteristics, Pricing, Marketing, Roads, Fleet Characteristics, Technology
- Combination of highest levels reduces GHG by just over 70%
- Technology (e.g. vehicle efficiency improvements) has the largest effect, then urban characteristics and pricing
In 2040, the 65 Plus segment of the population is forecast to be 21% in Oregon, and 32% in Florida.
Age in EERPAT - an Important “Driver” of GHG

Generate synthetic households
- Population synthesizer creates a population that has the correct age profile
- Household income model assigns incomes based on age profile in the household

Model initial estimates of household vehicle travel
- Models predict lower VMT for lower incomes and lower vehicle ownership
- Plus 65 households more likely to have zero VMT, lower average VMT
- Budget constraint models the effects of travel costs: lower income households affected more by price increases, e.g. higher gas prices

Recalculate household vehicle travel and adjust allocation to vehicles

Model vehicle ownership types and ages
- Models include income variables (which are dependent on age)
- Households with only plus 65s more likely to be zero vehicle or low vehicle ownership households

Other policy responses
- Workplace TDM: have to be in workforce
- EV, PHEV: depends on daily VMT, plus 65s more likely to stay within charge range
~33% Reduction in CO₂e from transportation sector
~20% Reduction in CO₂e after including electric grid (ignoring grid emissions equivalent to not counting the emissions of 400,000 gasoline cars)
Future Plans for EERPAT

- Additional pilots and technical assistance (4-6 State DOTs)
- Development of basic input data for all states
- Additional reporting enhancements
- FHWA training and outreach
For More Information

- Visit www.planning.dot.gov/FHWA_tool/
  - Tool, user guide, model documentation, Florida example

- Reference Sourcebook
  - Available at the same web site, it
    - describes various transportation-related greenhouse gas mitigation strategies,
    - estimates the potential range of GHG reductions,
    - estimates costs and identifies barriers to implementation,
    - identifies example projects, and
    - describes any associated co-benefits or disadvantages

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