Development of a Regional Greenhouse Gas Inventory and Forecast Including Direct and Consumption-Based/Energy-Cycle Emissions

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Outline

• Objective
• Inventory Approach
• Sample Methods and Results
  – Solid Waste Management
  – Onroad Transportation
Objective

- Create region-wide Inventory & Forecast for North Jersey Transportation Planning Authority
- 13 counties and over 350 municipalities
- Allow counties and municipalities to begin GHG mitigation planning
- Clearly inform planners of relative merits of mitigation actions
NJTPA Region
Inventory Approach: Accounting Methods

- Direct and Consumption-Based GHG emissions
  - Direct: emissions at the source (e.g., of fuel combustion, process, etc.)
  - Consumption-Based: emissions attributed to the point of some GHG emitting activity (e.g., trip origin/destination, waste or wastewater generation)

- Energy-cycle emissions
  - Emissions from upstream fuel cycle (extraction, transport, processing/refining, distribution)
Inventory Approach: Accounting Methods – Pros and Cons

- Direct emissions are only basis for adding emissions cumulatively without double-counting
- National, State, and other local inventories primarily developed on direct emissions basis
- Consumption-based plus energy-cycle emissions may best fit needs of mitigation planners
Example of Direct vs. Energy-cycle Emissions

New Jersey 2005 Inventory & Forecast
Solid Waste Management Inventory

• Includes solid waste landfills, composting, recycling, and residential open burning

• Direct Emissions
  – Landfill and composting facility data provided by NJDEP
  – Residential open burning based on per capita burning rate
  – No direct recycling emissions
Solid Waste Management Inventory

• Consumption-based Emissions
  – Solid waste management profile developed for each county
  – Waste generated in county that is sent to landfill or composting facility regardless of facility location
  – WARM transportation emission factor used for landfilling, recycling, and composting

• Energy-cycle Emissions
  – Emissions factors for embedded emissions from WARM
  – Process energy, non-energy process emissions, transportation of raw materials and manufactured goods
  – Dependent on waste composition
Ocean County Waste Management Profile

- MSW Landfill Disposal at County Landfills: 57%
- MSW Disposal Export to Landfills: 27%
- MSW Disposal - Residential Open Burning: 12%
- MSW Recycling: 2%
- MSW Composting: 2%
Solid Waste Management Forecast

• Direct Emissions
  – Assumed constant waste emplacement at landfills until anticipated year of closure
  – Composting based on state annual average growth rate for 2000-2006
  – Open burning forecast based on population growth

• Consumption and Energy-Cycle Emissions
  – Based on each county’s per-capita waste generation growth rate for 1995-2006
Ocean County Municipal Solid Waste Management Direct GHG Emissions

- MSW Landfill - Disposal
- Composting - CH4 and N2O
- Residential Open Burning
Ocean County Municipal Solid Waste Management Consumption-based GHG Emissions

- Residential Open Burning
- Composting - Transportation
- Composting - CH4 and N2O
- Recycling - Transportation
- MSW Landfill - Transportation
- MSW Landfill - Disposal
Example of Direct vs. Consumption-based/Energy-cycle Emissions

Municipal Solid Waste Sector Emissions by Accounting Method

- Energy-Cycle Emissions
- Consumption Emissions
- Direct Emissions
Highway Transportation

• Includes all onroad vehicles
  • Activity data from NJTPA Transportation Model
    • Link and zone level transportation data
• Emission factors calculated using EPA’s MOVES2010 model
  – CO₂, CH₄, N₂O
• Emissions calculated within customized software (PPSUITE)
Highway Transportation

• Direct Emissions
  – Includes emissions for travel occurring within municipality/county
  – Excludes portion of trip occurring outside region
  – EPA’s MOVES model

• Consumption-based Emissions
  – Includes half of emissions from any trip originating or ending within the municipality
  – Trips over which the county or municipality has some control
Direct versus Consumption-Based VMT

Internal Trip: Direct VMT = Consumption VMT

Through Trip: Direct VMT = portion in MCD; Consumption VMT = 0

Origin Trip: Direct VMT = portion within MCD; Consumption VMT = 50% of total trip VMT
Example of Direct vs. Consumption-based Emissions

North Jersey Highway Vehicle Emissions

- **Direct Estimate**
- **Consumption Estimate**
Example of Direct vs. Consumption-based Emissions

Municipal Highway Vehicle Emissions

<table>
<thead>
<tr>
<th>Location</th>
<th>Direct Estimate</th>
<th>Consumption Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Rutherford</td>
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<td>150,000</td>
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<tr>
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<tr>
<td>Fort Lee</td>
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</table>
Summary

• Pros and cons to different accounting methods.
  – Direct emissions can be added cumulatively without double-counting and are used by most other National, State, and local inventories
  – Consumption-based plus energy-cycle emissions may better inform planners for some sectors

• Estimating emissions for direct, consumption-based, and energy-cycle emissions provides more flexibility to mitigation planners