Producing a NYMTC GHG Inventory
What is a GHG Inventory?

“A greenhouse gas inventory is an accounting of greenhouse gases (GHGs) emitted to or removed from the atmosphere over a period of time” - EPA

**Geography**
- Nation
- State
- Region
- Municipality

**Sector**
- Electricity (production/consumption)
  - Fossil Fuel Use
  - Transportation
  - Industrial Processes
- Fossil Fuel Production
- Agriculture
- Land Use, Land Use Change, and Forestry (LULUCF)
- Solid Waste Management

- Carbon Dioxide (CO2)
- Methane (CH4)
- Nitrous Oxide (N2O)
- Sulfur Hexafluoride (SF6)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
Why a NYMTC GHG Inventory?

As established in the **NYMTC 2035 Plan**, GHG reductions are part of our commitment to reducing the adverse effects of climate change on the region.

A regional GHG Inventory will:

- **Create a regional platform** for reduction strategy including:
  - **Analysis** of current emissions dynamics
  - **Identification** of areas of concern
  - **Creation** of metrics for mitigation measures
- **Evaluation** of current progress and future challenges
National Transportation Emissions

Share of U.S. GHG Emissions by End-Use Sector*
* Note: Totals may not add to 100% due to rounding

Share of U.S. Transportation End-Use Sector GHG Emissions by Source*
* Note: Totals may not add to 100% due to rounding

Share of U.S. Transportation End-Use Sector GHG Emissions by Gas*
* Note: Totals may not add to 100% due to rounding
National Transportation Emissions

Figure 1. U.S. GHG Emissions Allocated to Economic Sectors, 1990 to 2010
What is the regional precedent?

4 area inventories have been conducted around NYMTC region

- NJTPA
- PlaNYC
- LI Carbon Footprint Project
- Mid-Hudson Tier II GHG Inventory
Methodology

**Direct**
- Emitted within MPO boundary
- Internal Combustion Engines
- Landfill Gases

**Consumption Based**
- Consumption of a product or utility generated outside of the MPO study area
- Upstream production costs

• All emissions are tabulated and then reported as metric tons of carbon dioxide equivalent (MTCO2e).

• A metric ton is 1,000 kilograms, or 2,206 pounds
Key Findings: NYC

* Note that aviation and marine vessels are not included
Key Findings: Mid-Hudson

Figure 1 - 2010 GHG Emissions in the Mid-Hudson Region, per Sector (percentages of total)

Note: Totals may not sum due to independent rounding.
Key Findings: Mid-Hudson

Note: “Other” included industrial processes, agriculture, and energy generation and supply.
Key Findings: Long Island

* Note aviation was not included in this inventory
Preliminary NYMTC Area GHG Analysis

Estimated NYMTC Region Transportation Sector CO2 Emissions

- NYC (11 million tons)
- Mid-Hudson (6.9 million tons)
- Long Island (12.02 million tons)

34.9 million tons total NYMTC Transportation Sector CO2 Emissions

*All emissions data are aggregated and reported as Metric Tons of CO2 Equivalent (MTCO2e) estimates based on totals from ICLEI Long Island Carbon Footprint Project (2010), PlaNYC (2010) and Final Report for Mid-Hudson Tier II Regional Greenhouse Gas Emissions (GHG) Inv
Regional Per Capita Analysis

<table>
<thead>
<tr>
<th>Region</th>
<th>Total Emissions</th>
<th>Transportation Sector Emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>NYC</td>
<td>6.5</td>
<td>1.3</td>
</tr>
<tr>
<td>Mid-Hudson</td>
<td>11.4</td>
<td>4.9</td>
</tr>
<tr>
<td>Long Island</td>
<td>12.4</td>
<td>4.2</td>
</tr>
</tbody>
</table>

**Emissions**
Case Study: NJTPA Inventory

“A GHG inventory is an accounting of GHGs emitted (sources) or removed from (sinks) the atmosphere over a period of time.”

Prepared by a consultant team:
• E.H. Pechan and Associates, Inc. (Pechan)
• AKRF, Inc. (AKRF)
Case Study: Geography

- Bounded by MPO jurisdiction

**Direct Emissions**
- Tied to year and Municipal Civil Division (MCD) where emitted
- Occasionally County or region when constrained by data

**Consumption Based Emissions**
- Assigned to area where activity occurred
- All related upstream emissions are assumed to occur in the same year
Case Study: Sectors

- Electrical Power Production and Use
- Residential, Commercial and Industrial Fuel Use
- Transportation
- Industrial Processes
- Fossil Fuel Industry
- Agriculture
- Land Use, Land Use Change, Forestry
- Solid Waste Management
- Wastewater Management
Transportation Sector Analysis

• Rail
  • NJ Transit-PANYNJ and National Association of Railroad Passengers data
  • Freight was estimated by density allocated on the county level
  • U.S. Census commodity flow survey estimated tonnage within region

• Recreational Vehicles
  • EPA’s 2008 Non-Road model
  • GREET Forecasting
  • Emissions allocated to sector based on NJDEP procedures and assumptions

• Marine Vessels
  • PA 2000 study data
  • Starcrest forecasting report generated 2006 estimates
  • 3 mile demarcation from shoreline

• Airports
  • EPA landing-takeoff data
  • PANYNJ data
  • Allocated to county NOT MCD

• All on road vehicles, both private and public.........
Transportation: On Road Analysis

Direct Emissions
• Estimates for highway vehicle travel link the location of the vehicle emissions assigned to the county with the associated roadway.

Data Source:
• NJTPA travel demand model (NJRTM-E)
• EPA’s MOVES 2010 model (for emissions factor) parameters updated to reflect local conditions

Process:
• NJRTM-E served as the primary data source for disaggregated activity estimates for incorporation into the MOVES model

• Post-processing of travel model outputs, and integration with MOVES, was done using AECOM’s PPSUITE software which is linked to the NJRTM-E.
Transportation: On Road Analysis

- **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
Transportation: On Road Analysis

Figure 2.1-1. 2006 NJTPA Regional Inventory of Direct GHG Emissions (85,836,959 tCO₂e)
## Transportation: On Road Analysis

### Sample VMT-Fuel based hybrid accounting methodology

<table>
<thead>
<tr>
<th>CO2 Emissions</th>
<th>$= \sum (\text{Activity} \times \text{Emission Factor})$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$= \sum (\text{VMT}<em>{ab} \times \text{FC}</em>{ab} \times \text{EF}_{ab})$</td>
</tr>
</tbody>
</table>

**where**

- **VMT** = activity level measured in annual vehicle miles traveled (miles/year)
- **FC** = fuel consumption per mile traveled (gallons per mile, 1/fuel economy)
- **EF** = emission factor (MT CO2/gallon of fuel)
- **a** = fuel type (diesel or gasoline)
- **b** = vehicle type

**Total GHG Emissions**

$= \text{CO2 emissions} \times (\text{MTCO2E}/\text{MTCO2})$
On Road Analysis and Forecasting

Estimates and forecasts account for:
- Through traffic
- Vehicle types
- Fuel mix

- Forecasting is difficult because of technological advances
On Road Analysis and Forecasting
On Road Analysis by County

2006

2050
Transportation: On Road Analysis

Consumption Based Emissions
- Unique Model, analyzed at MCD Level

- Assumed that half of all trips originating or ending in MCD can be affected by mitigation

- Not broken down by vehicle/road type

- Trips are considered to be under town jurisdiction and subject to mitigation
Transportation: On Road Analysis

Consumption based emissions by sector

- Transportation: 19.0%
- Electricity: 31.0%
- RCI Fuel Use: 26.0%
- Industrial Processes: 12.0%
- Solid Waste Management: 11.0%
- Wastewater Treatment: 0.9%
Transportation: On Road Analysis

Energy Cycle Emissions
• Includes all production and transport of diesel fuel residual oil for on road sector

Data Sources:
• Estimates come from Argonne National Laboratory’s GREET (GHG Regulated Emissions and Energy Use in transportation) model
  • GREET model 1990-2020 forecasting with data from NJTRTM-E (disaggregated activity) estimates
  • MOVES model estimates

Process:
• Analysis comes from PPSUITE transportation network analysis
Scope of Work

- Estimate cost is $150K

- Cost could be reduced by front end agency coordination with local municipalities and our members

- 9-18 months to complete depending on consultant retention process and data post processing needs

- Potentially enhanced by preliminary outreach to municipalities regarding data availability, needs and potential application of data and forecasting products
References

SJTPO. Regional Greenhouse Gas Emissions Inventory. Steering Committee Presentation November, 12th 2013

NJTPA. Request for Proposal. “Regional Greenhouse Gas Emissions Inventory and Climate Change Planning” August 7th, 2009

NYSERDA. “Final Report for Mid-Hudson Tier II Regional Greenhouse Gas Emissions (GHG) Inventory” December 13th, 2012


LICF. “Green House Gas Inventory 2005-2011 Comparison”. February 2013

Questions?

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