

# 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 (CO<sub>2</sub>)
- Methane (CH<sub>4</sub>)
- Nitrous Oxide (N<sub>2</sub>O)
- Sulfur Hexafluoride (SF<sub>6</sub>)
- Hydroflourocarbons (HFCs)
- Perflourocarbons (PFCs)



# Why a NYMTC GHG Inventory?

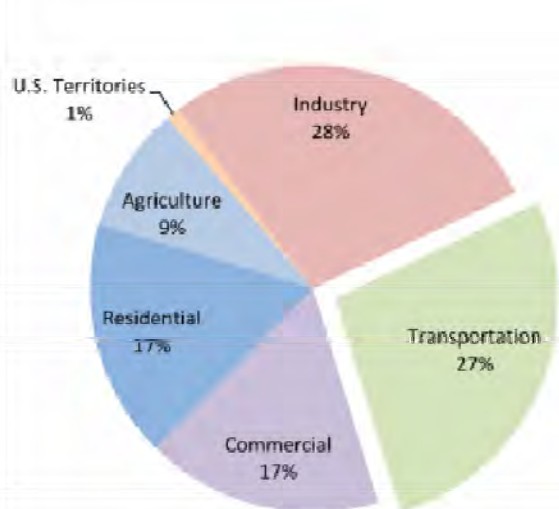
As established in the **NYMTC 2035 Plan**, GHG reductions are part of our commitment to reducing the adverse effects of climate change on the region.

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

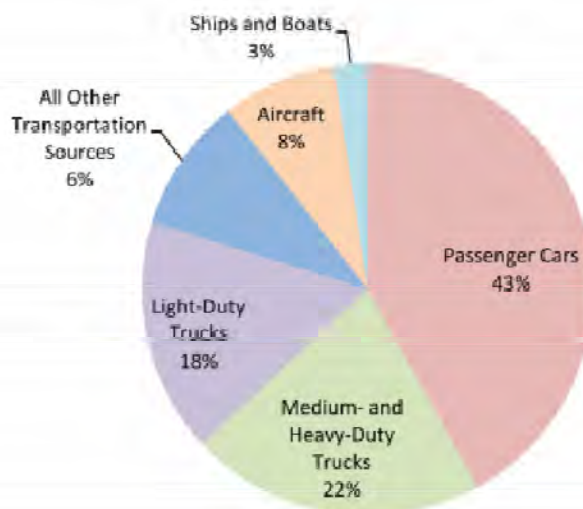


# National Transportation Emissions



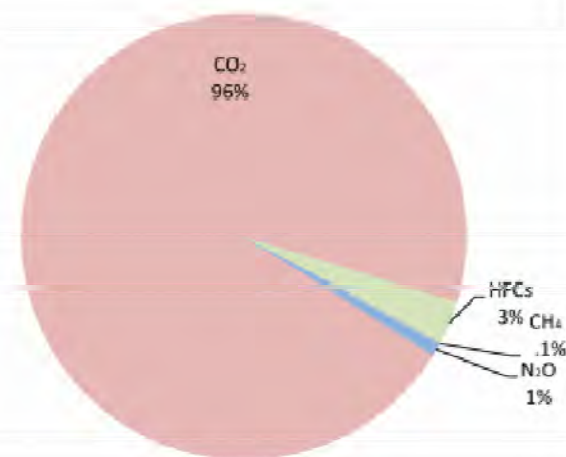
Share of U.S. GHG Emissions by End-Use Sector\*

\* 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.

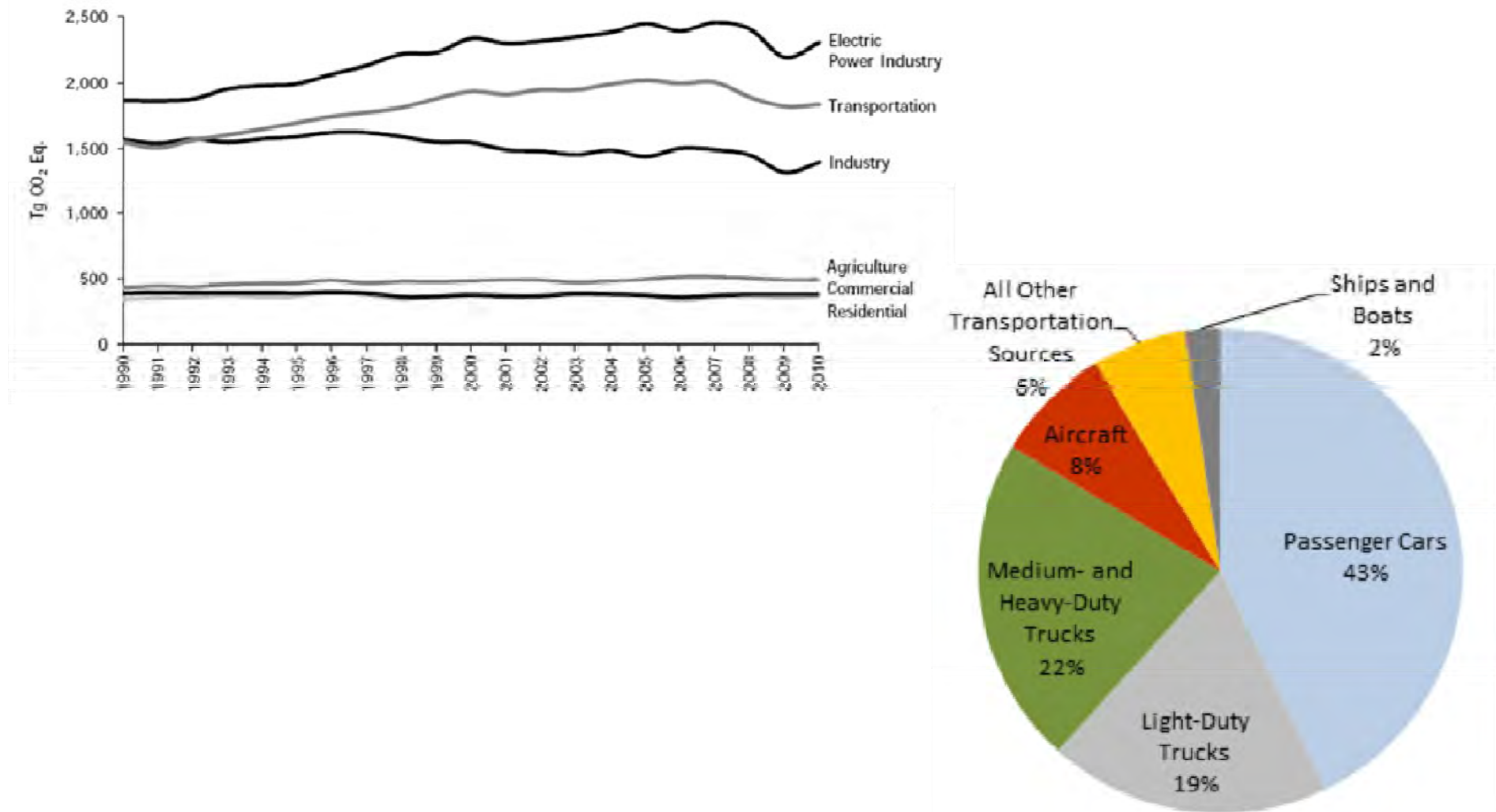


Share of U.S. Transportation End-Use Sector GHG Emissions by Gas\*

\* 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 (MTCO<sub>2</sub>e).

•A metric ton is 1,000 kilograms, or 2,206 pounds

# Key Findings: NYC

## 2010 Citywide CO<sub>2</sub>e Emissions by Sector

Total = 54.3 million metric tons

Buildings = 75%

■ Residential

■ Commercial

■ Industrial

■ Institutional

Transportation = 21%

■ On-road transportation

■ Transit

Wastewater, fugitive = 2%

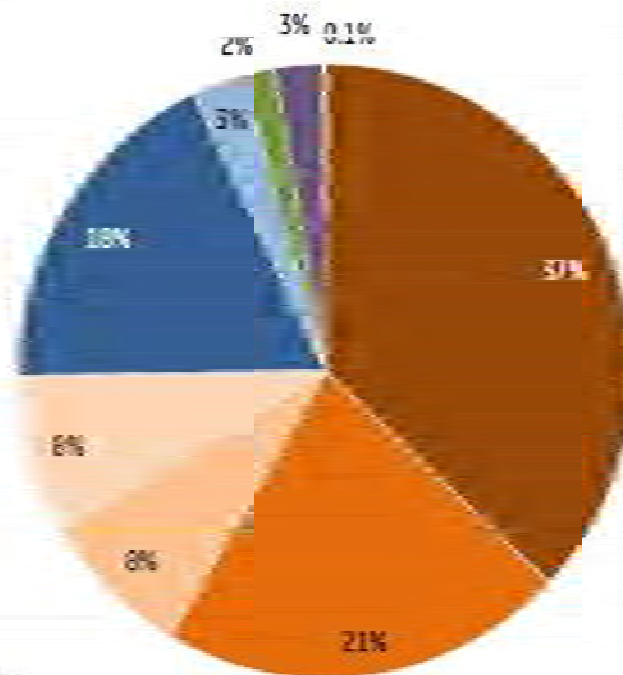
■ Wastewater, fugitive

Solid waste = 3%

■ Solid waste

Streetlights and traffic signals = 0.1%

■ Streetlights and traffic signals



## Citywide CO<sub>2</sub>e Emissions by Source

Total = 54.3 million metric tons

fuels = 96%

#2 fuel oil

#4 fuel oil

#5 fuel oil

Compressed natural gas

Diesel

Electricity

Gasoline

Natural gas

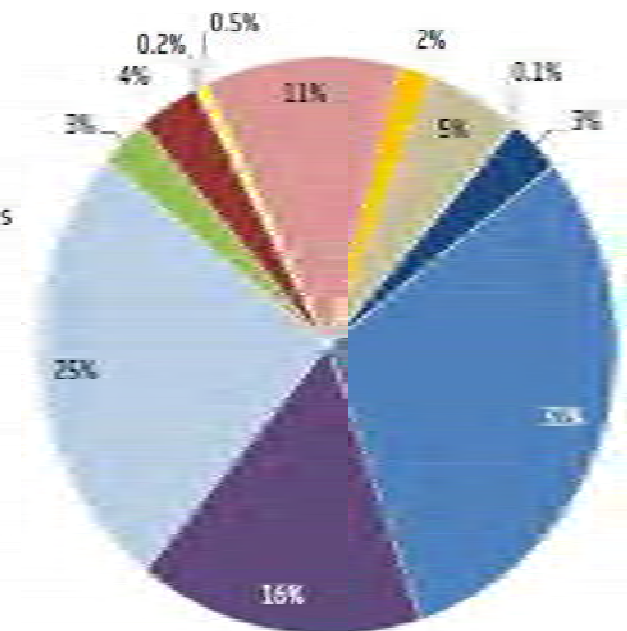
Steam

Other emissions = 4%

Methane

Nitrous oxide

Sulfur hexafluoride

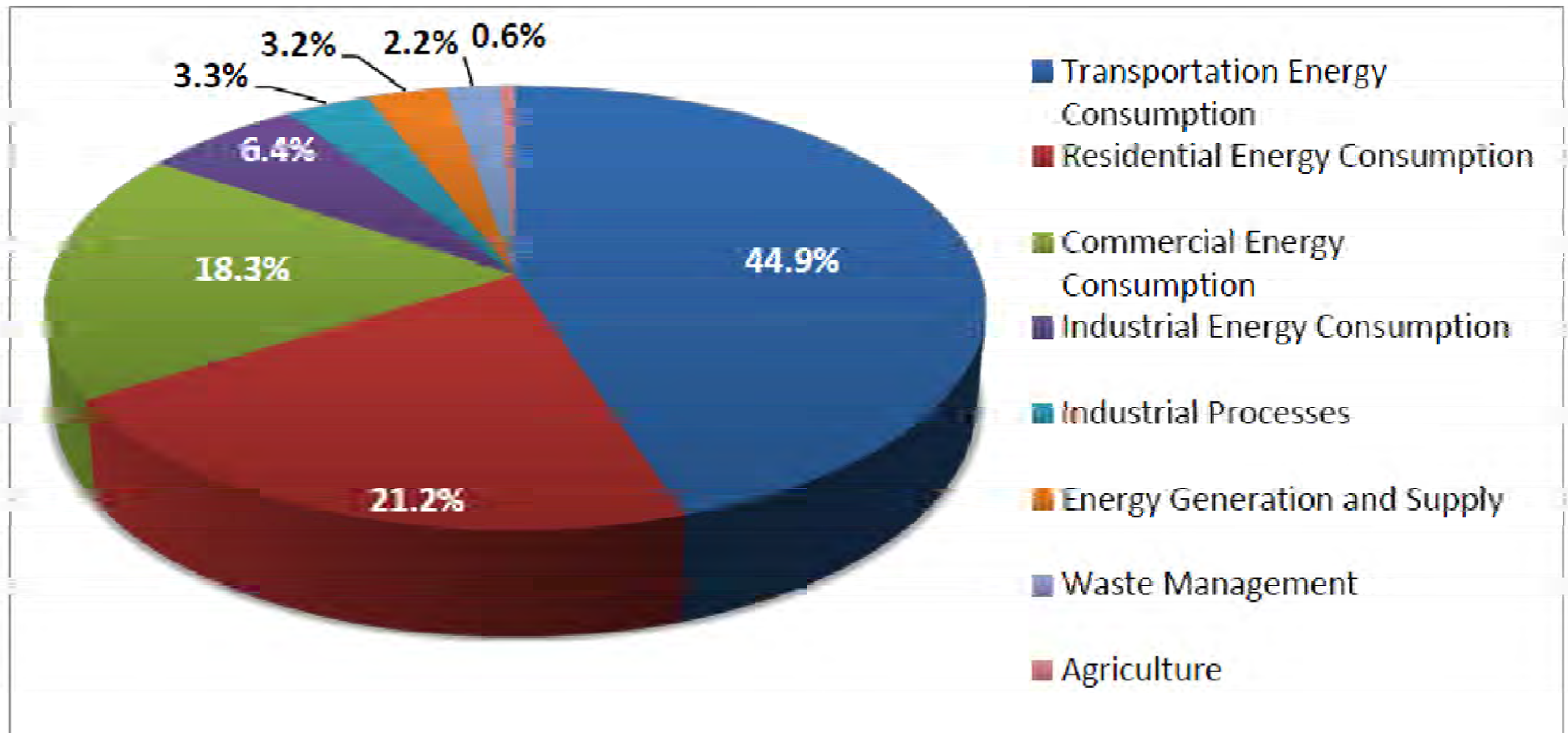


\* Note that aviation and marine vessels are not included



# Key Findings: Mid-Hudson

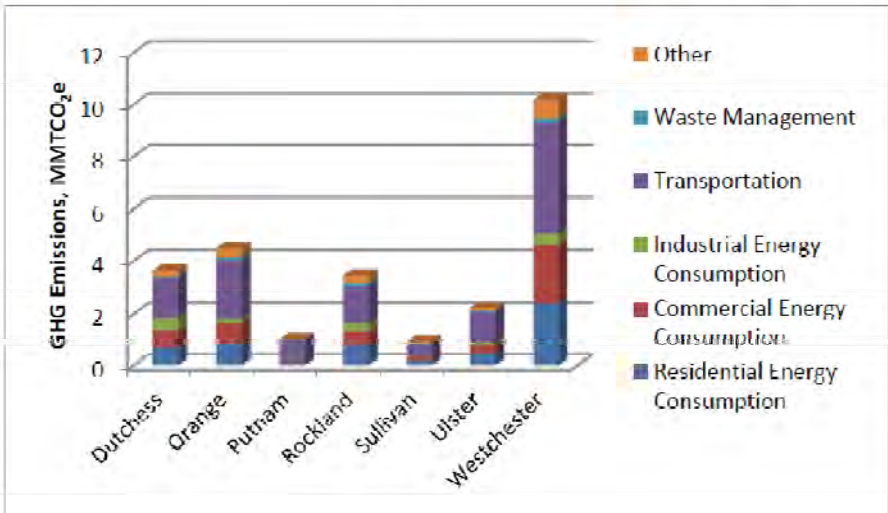
Figure 1 - 2010 GHG Emissions in the Mid-Hudson Region, per Sector (percentages of total)



Note: Totals may not sum due to independent rounding.

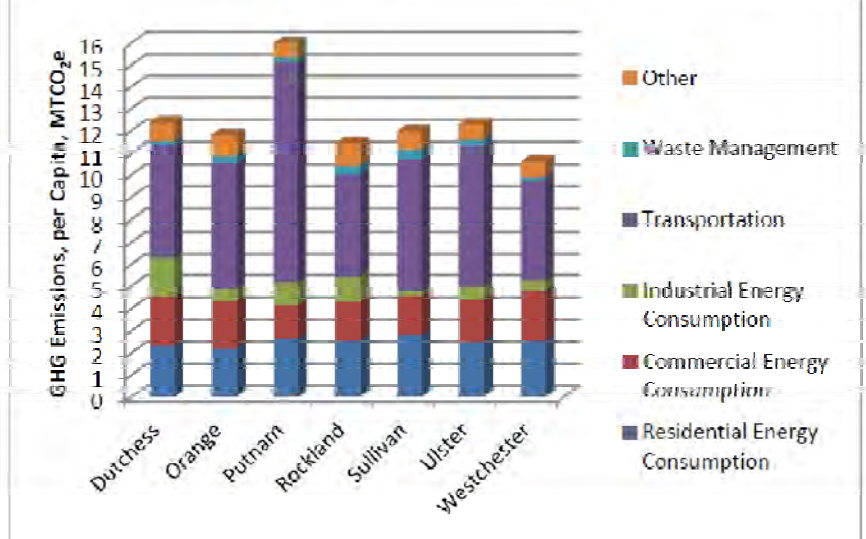
# Key Findings: Mid-Hudson

Figure 2 - 2010 GHG Emissions in Each County of the Mid-Hudson Region, per Sector (million MTCO<sub>2</sub>e)



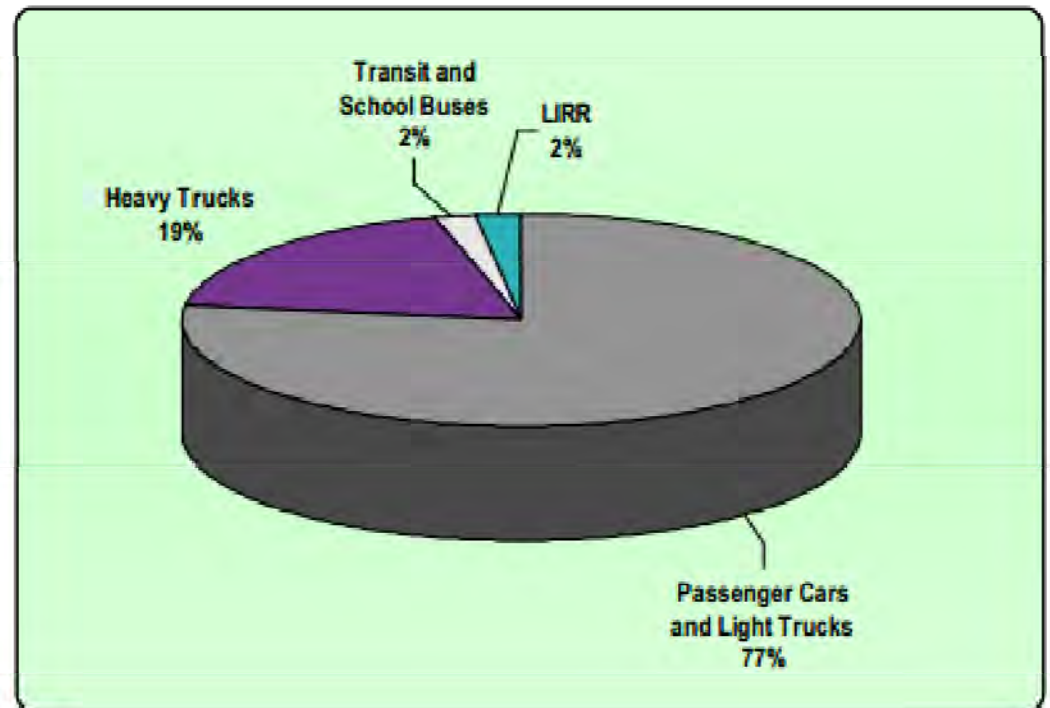
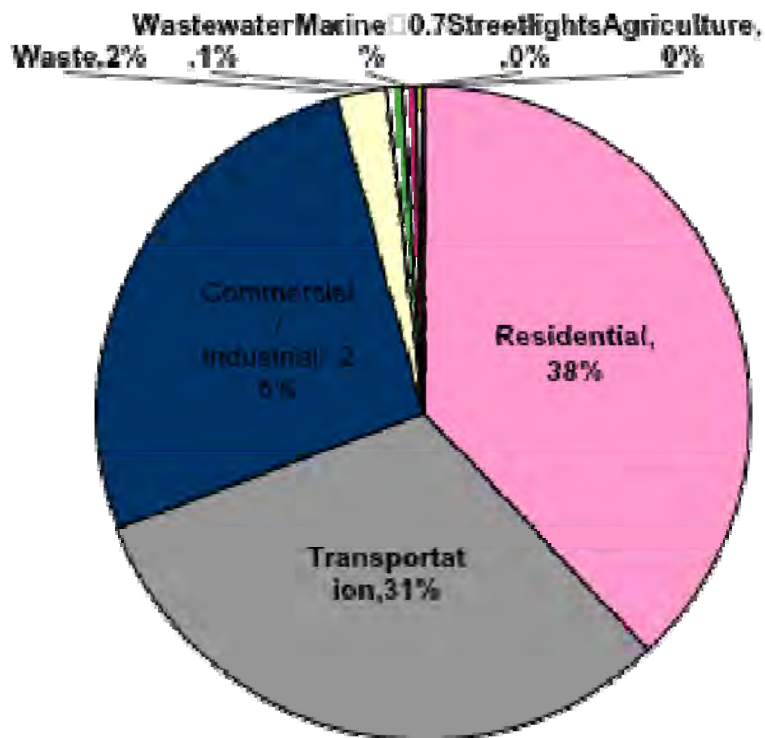
Note: "Other" included industrial processes, agriculture, and energy generation and supply.

Figure 3 - 2010 GHG Emissions in Each County of the Mid-Hudson Region, per Capita, per Sector (MTCO<sub>2</sub>e)



Note: "Other" included industrial processes, agriculture, and energy generation and supply.

# Key Findings: Long Island



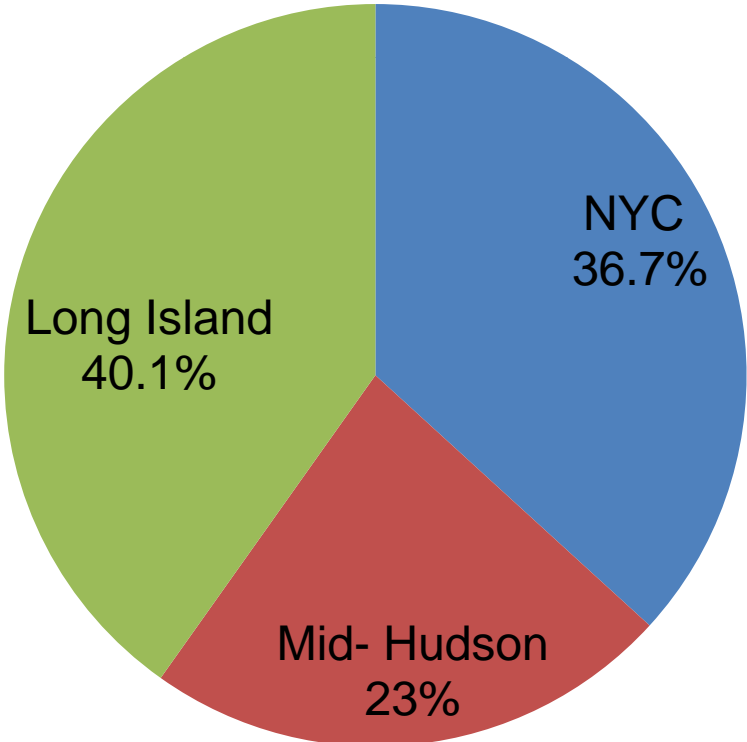
Source: Calculations were completed by ICLEI USA based on data from NYMTC – 2008-2010.

\* Note aviation was not included in this inventory

# Preliminary NYMTC Area GHG Analysis

## Estimated NYMTC Region Transportation Sector CO2 Emissions

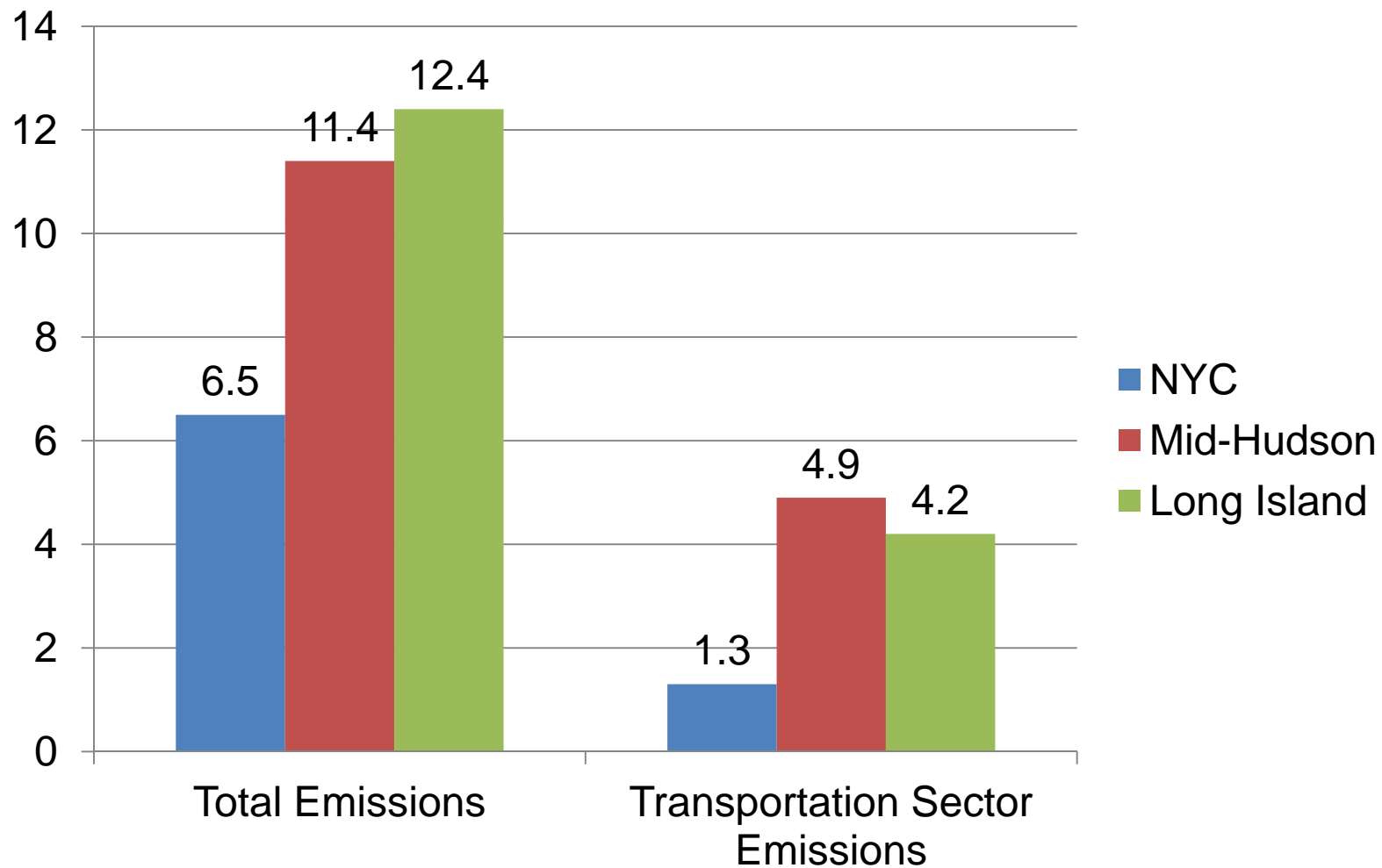
34.9 million tons total NYMTC  
Transportation Sector CO2 Emissions



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

\*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



# 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.”

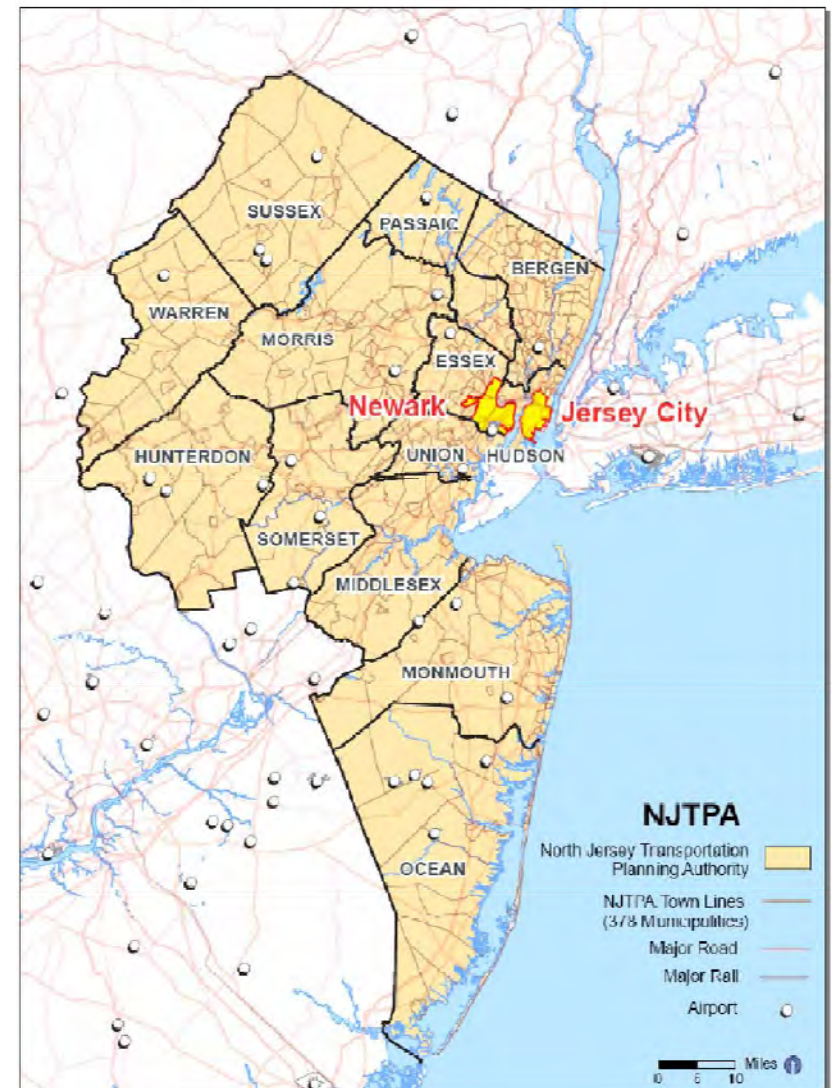
Prepared by a consultant team:

- 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

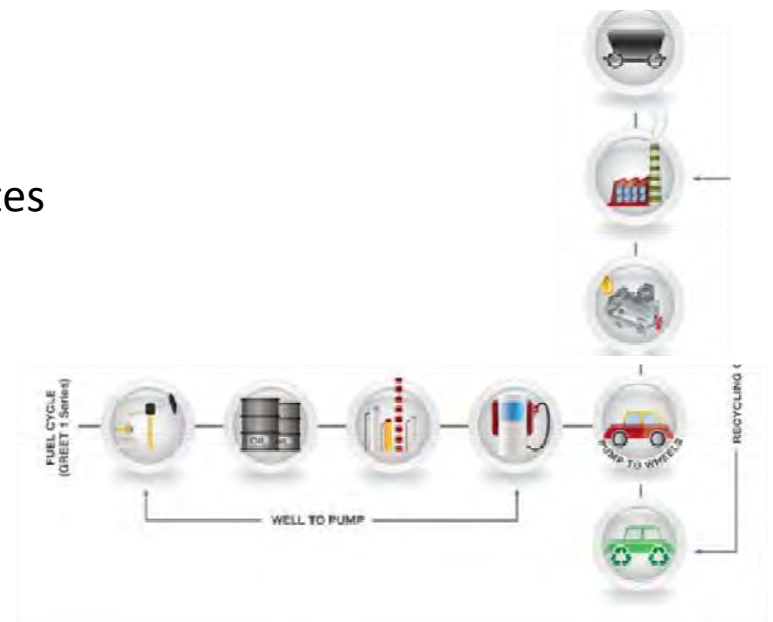
## •Marine Vessels

- PA 2000 study data
- Starcrest forecasting report generated 2006 estimates
- 3mile 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:

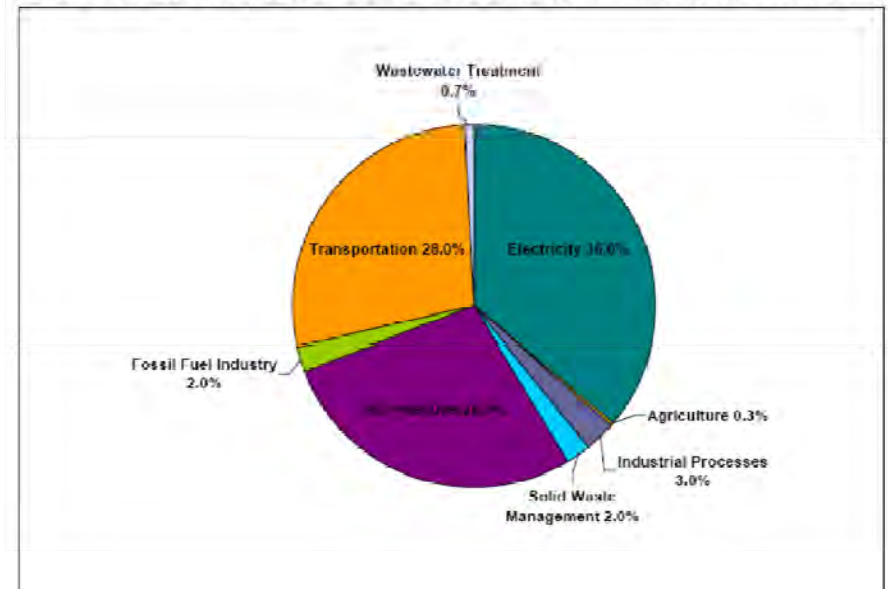
- NJTPA travel demand model (NJRTM-E)
- EPA's MOVES 2010 model (for emissions factor) parameters updated to reflect local conditions

## Process:

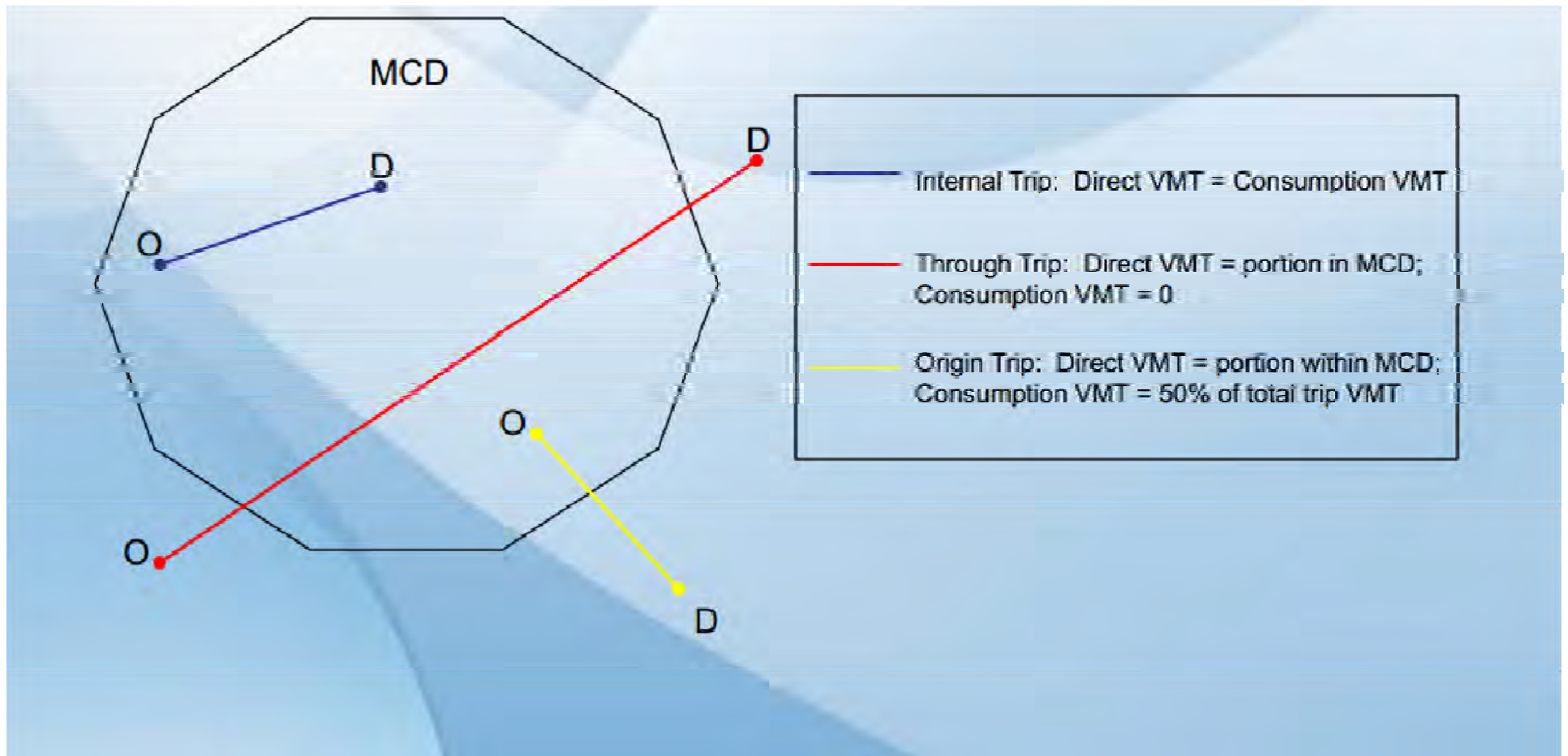
- NJRTM-E served as the primary data source for disaggregated activity estimates for incorporation into the MOVES model

- Post-processing of travel model outputs, and integration with MOVES, was done using AECOM's PPSUITE software which is linked to the NJRTM-E.

Figure 2.1-1. 2006 NJTPA Regional Inventory of Direct GHG Emissions (85,836,959 tCO<sub>2</sub>e)

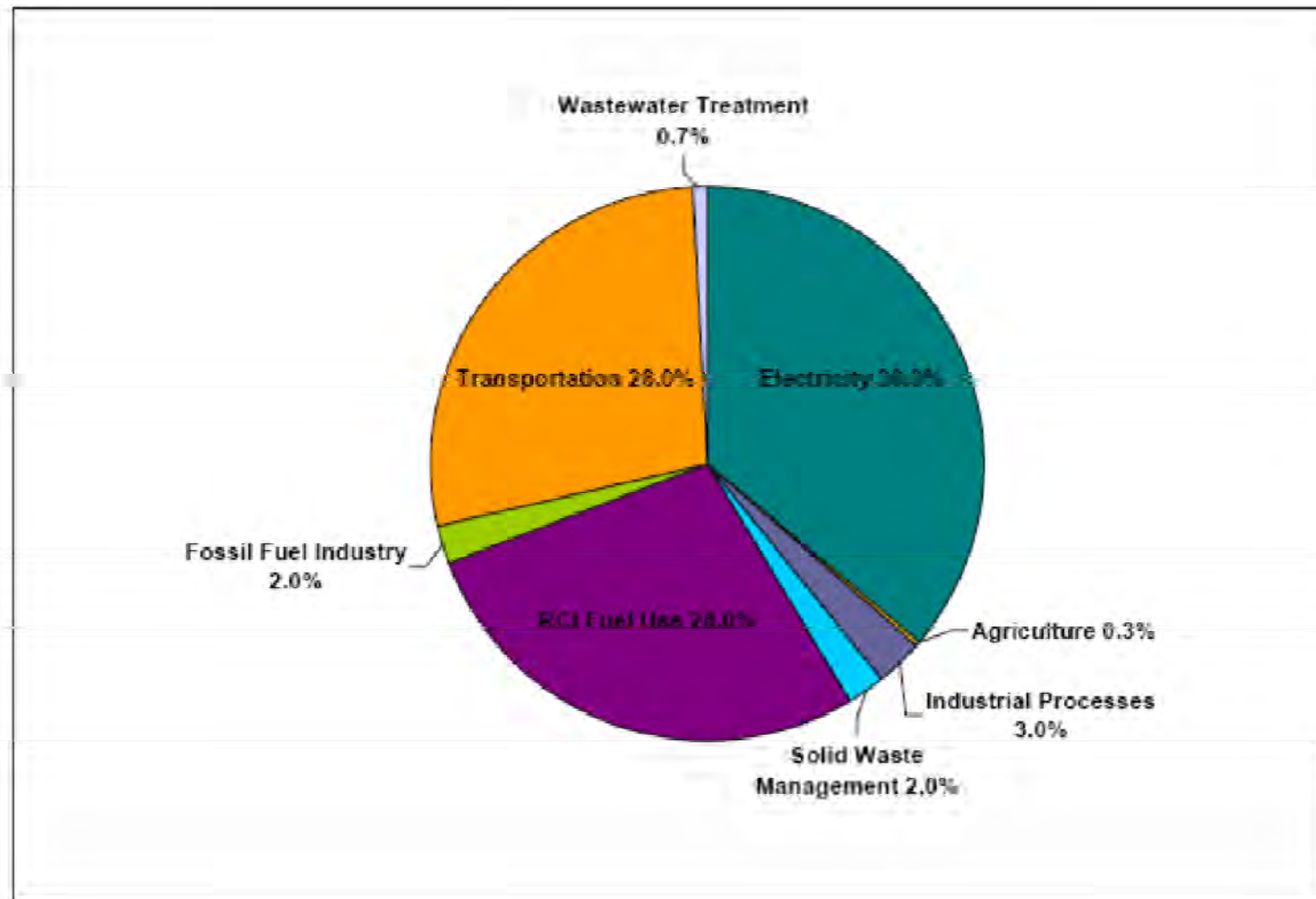


# Transportation: On Road Analysis



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Figure 2.1-1. 2006 NJTPA Regional Inventory of Direct GHG Emissions (85,836,959 tCO<sub>2</sub>e)



# Transportation: On Road Analysis

Sample VMT-Fuel based hybrid accounting methodology

CO2 Emissions	= $\Sigma(\text{Activity} \times \text{Emission Factor})$		
	= $\Sigma(\text{VMT}_{ab} \times \text{FC}_{ab} \times \text{EF}_{ab})$		
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	= CO2 emissions x (MTCO2E/MTCO2)		

# On Road Analysis and Forecasting

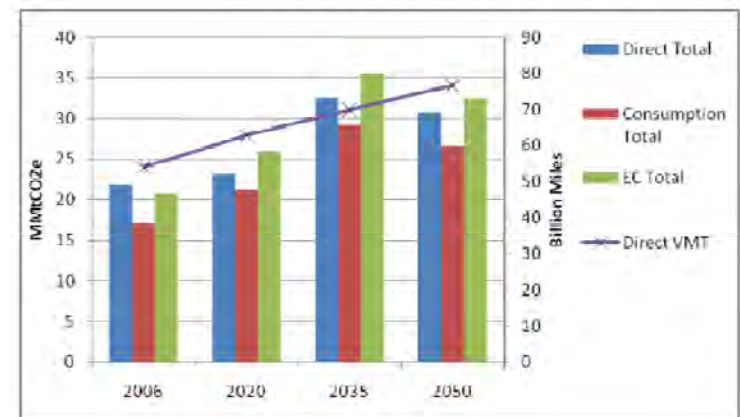
Estimates and forecasts account for

- Through traffic
- Vehicle types
- Fuel mix
- Forecasting is difficult because of technological advances

Table A.3.1-5. NJTPA Direct Annual VMT Summary by Source Type (thousand miles)

Source Type ID	Source Type	2006	2020	2035	2050
11	Motorcycle	171,113	200,218	226,098	249,912
21	Passenger Car	30,624,093	35,077,878	39,804,403	43,812,664
31	Passenger Truck	12,107,740	14,093,337	15,712,503	17,243,385
32	Light Commercial Truck	9,630,516	11,203,385	12,440,537	13,631,744
41	Intracity Bus	89,282	102,660	106,611	111,475
42	Transit Bus	33,283	38,310	39,784	41,607
43	School Bus	269,157	309,163	321,356	335,983
51	Refuse Truck	4,624	5,355	5,571	5,845
52	Single Unit Short-haul Truck	571,419	656,995	682,262	713,302
53	Single Unit Long-haul Truck	49,376	56,778	58,961	61,646
54	Motor Home	76,137	80,177	81,747	87,891
61	Combination Short-haul Truck	182,174	209,460	217,536	227,430
62	Combination Long-haul Truck	113,219	161,675	171,001	178,790
<b>Total</b>		<b>53,903,058</b>	<b>62,748,586</b>	<b>69,885,930</b>	<b>76,646,474</b>

Figure A.3.1-1. CO<sub>2</sub>e Emissions and VMT in North Jersey



# On Road Analysis and Forecasting

Figure A.3.1-4. 2006 Direct CO<sub>2</sub>e Emissions by Vehicle Type (MMtCO<sub>2</sub>e)

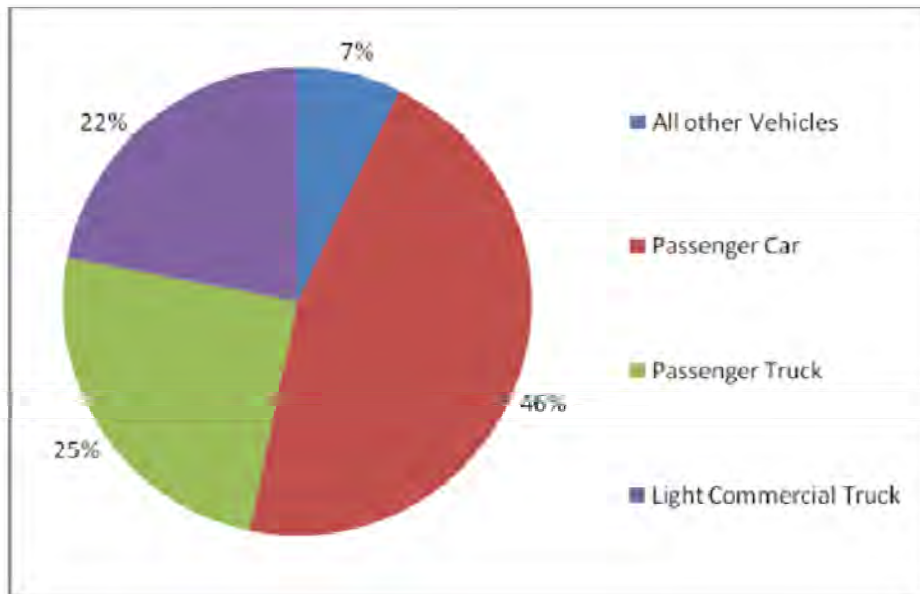
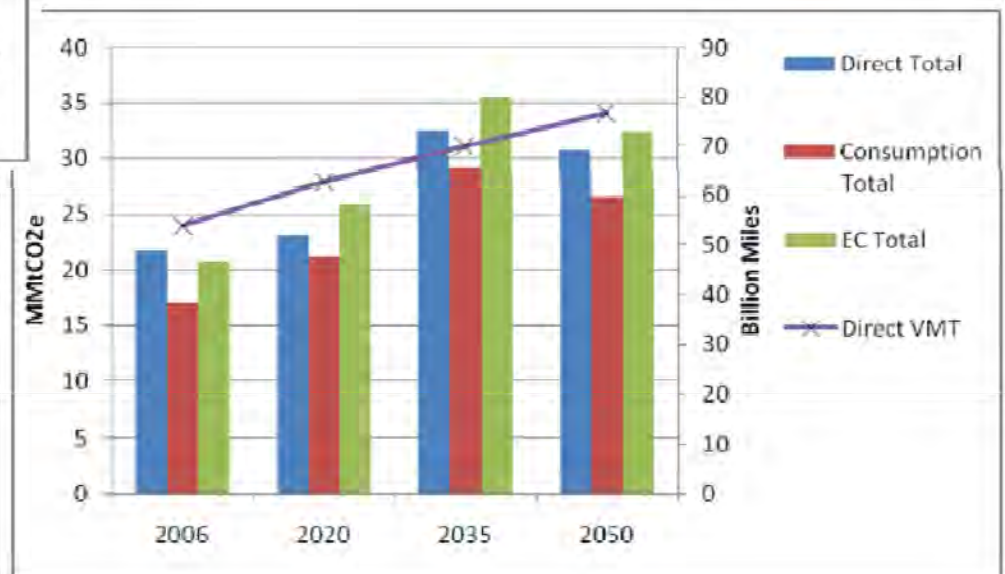
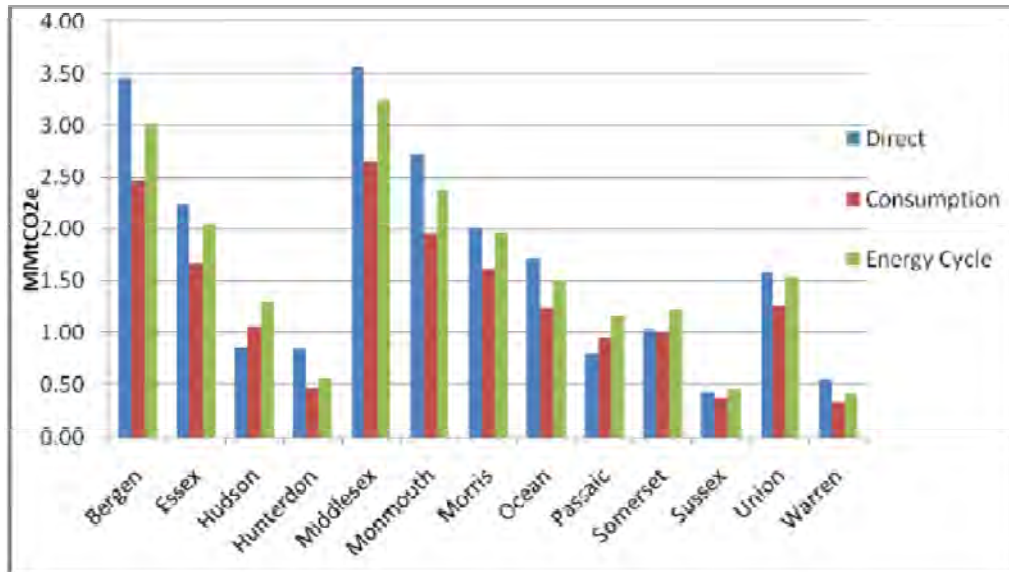


Figure A.3.1-1. CO<sub>2</sub>e Emissions and VMT in North Jersey

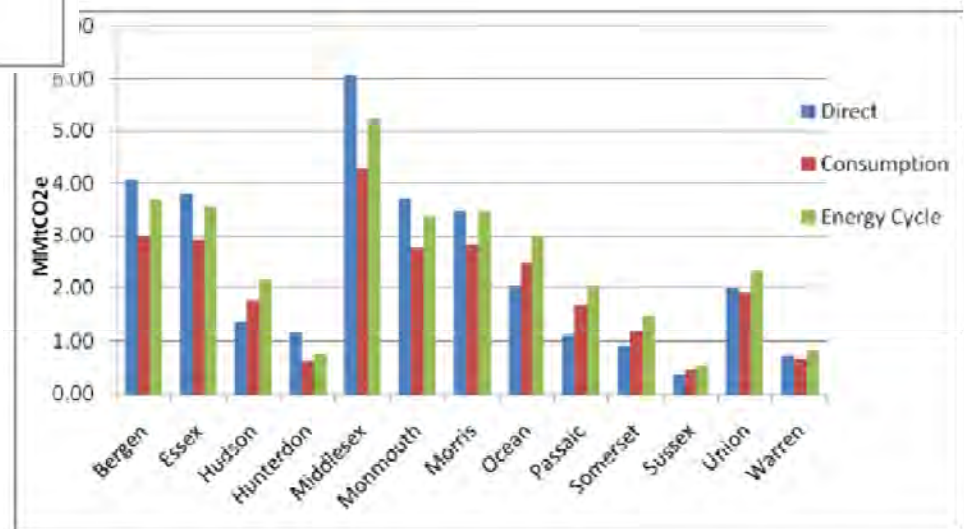


# On Road Analysis by County

2006



2050



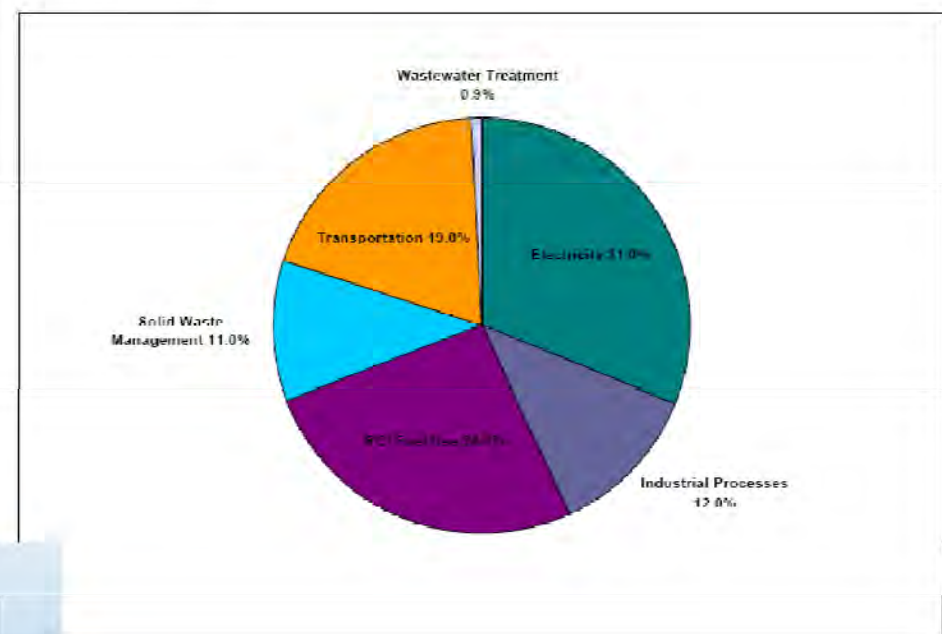


# Transportation: On Road Analysis

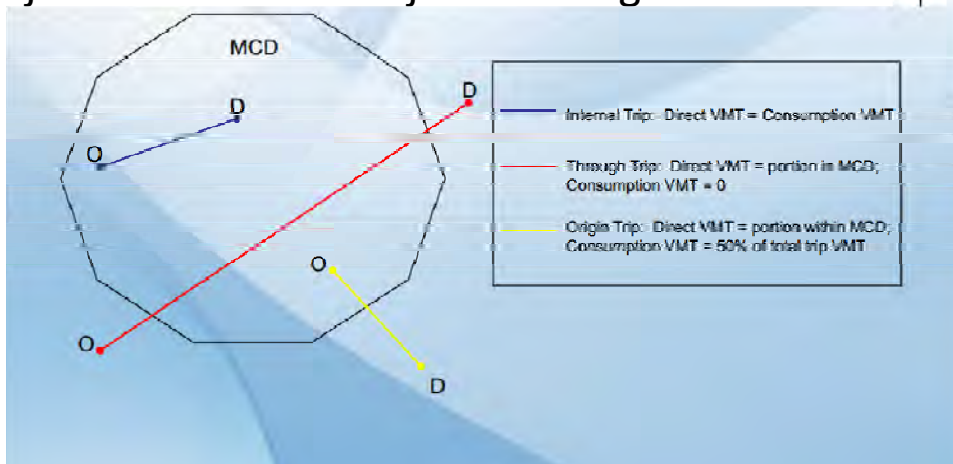
## Consumption Based Emissions

- 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

Figure 2.1-2. 2006 NJTPA Regional Inventory of Consumption-Based + Energy-Cycle GHG Emissions (107,034,556 tCO<sub>2</sub>e)

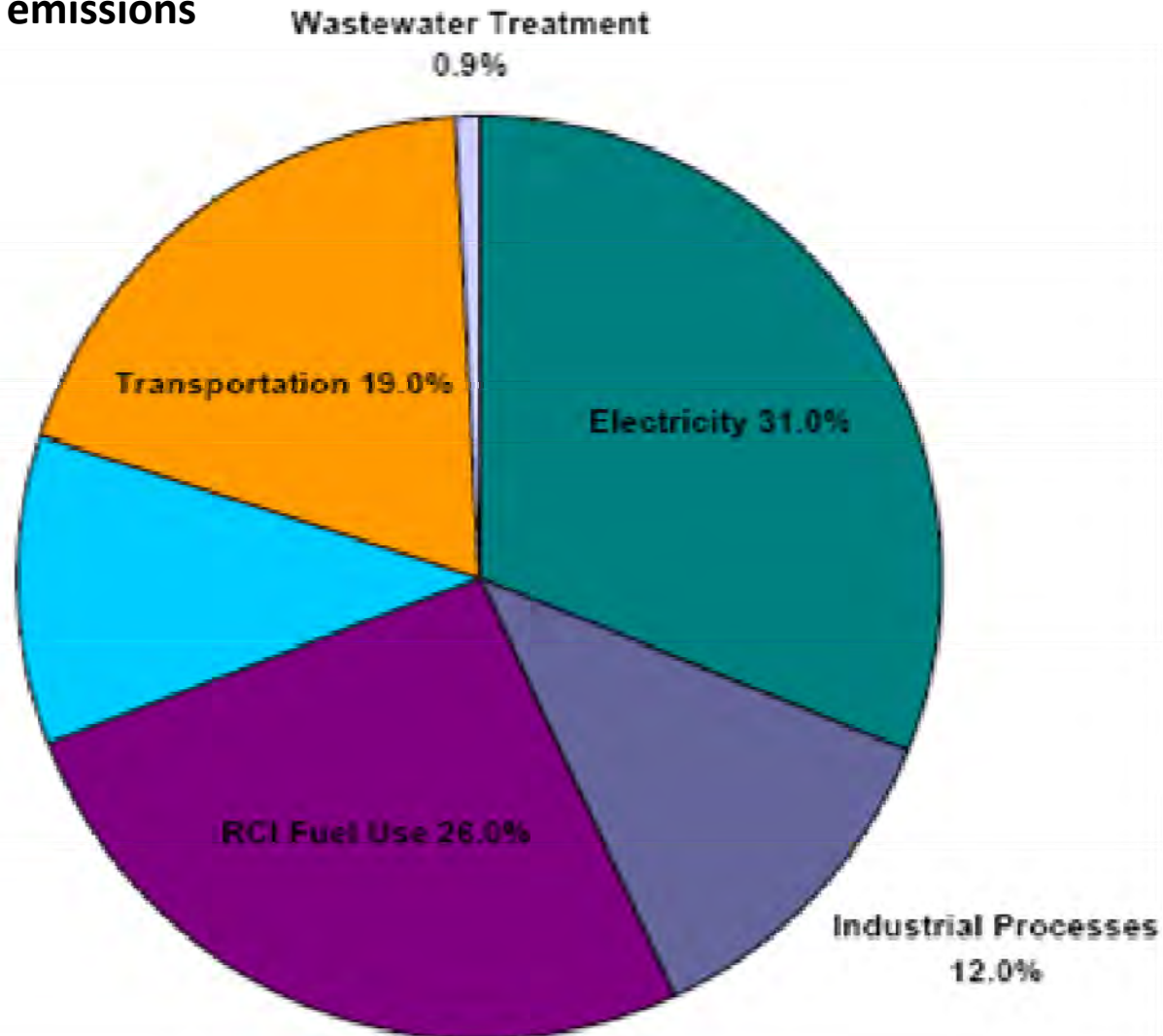


no consumption-based inventories for the agriculture and forestry sectors were prepared for this project.



# Transportation: On Road Analysis

Consumption based emissions  
by sector



# Transportation: On Road Analysis

## Energy Cycle Emissions

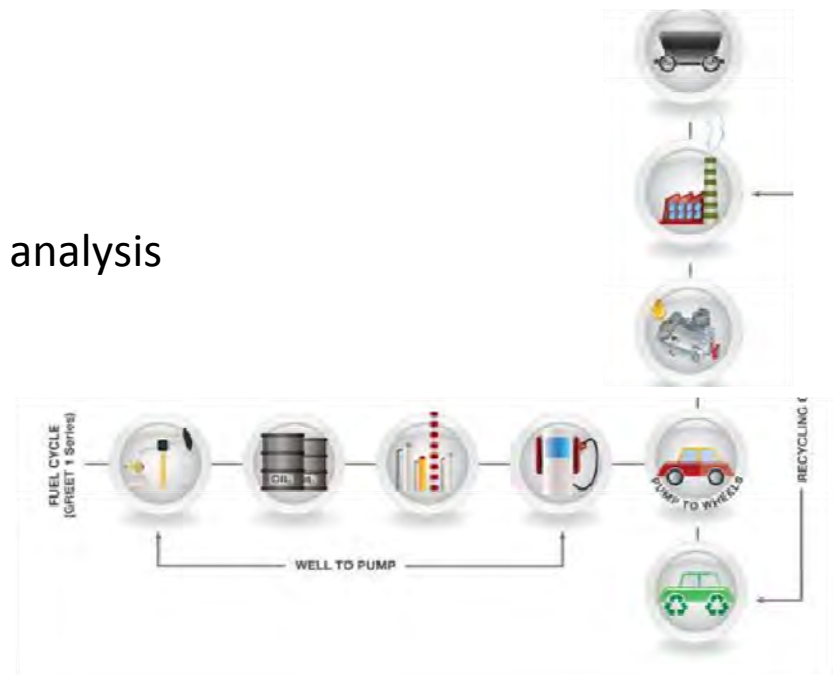
- Includes all production and transport of diesel fuel residual oil for on road sector

### 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, 12<sup>th</sup> 2013

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

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

NYC Office of the Mayor. “PLANYC Inventory of New York City Greenhouse Gas Emissions”. December 2012

NJTPA. “Regional Greenhouse Gas Emissions Inventory and Forecast Final Report”. June 2011

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

FHWA. “Handbook for Estimating Transportation Greenhouse Gases for Integration into the Planning Process. Chapter 2”.

**Questions?**

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