



# Improving the Transportation Component of State Greenhouse Gas Emissions Inventories

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# Overview

- History of state inventories and current practice
- Potential Methodological improvements
  - Disaggregation by mode / vehicle category / activity
  - Refinement of disaggregated estimates
- Challenges
  - Technical issues
  - Engaging relevant policies
- Recommendations



# GHG Emissions Inventory - History

- National greenhouse gas inventories established under the United Nations Framework Convention on Climate Change (Ratified in 1992 by U.S.)
- Reporting guidelines established under Working Group I of Intergovernmental Panel on Climate Change in 1996
  - Ensure that emissions inventories submitted to UNFCCC are consistent and comparable

# Beginnings of State Inventories

- EPA initiated the State and Local Climate Change Program (SLCCP) in 1992
  - Objective of building capacity in state and local governments and encourage them to take action to reduce GHG emissions
  - Encouraged states to prepare their own GHG inventories
- Through the SLCCP, the EPA has developed and published guidance for states to produce GHG inventories.
  - Guidance was first issued in 1992 and is updated regularly to be consistent with methodologies for the U.S. Inventory
  - EPA methods conform to international guidance issued by IPCC
  - EPA has also issued spreadsheet-based tools to assist states with the development of inventories

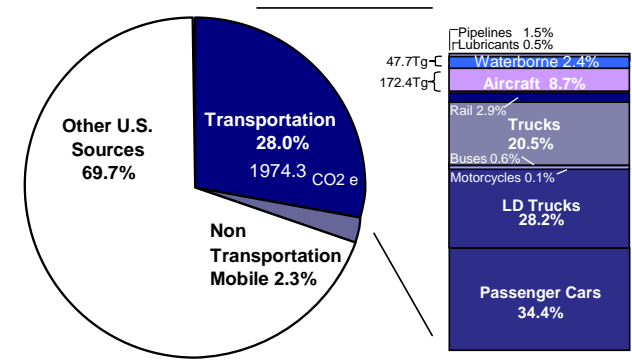
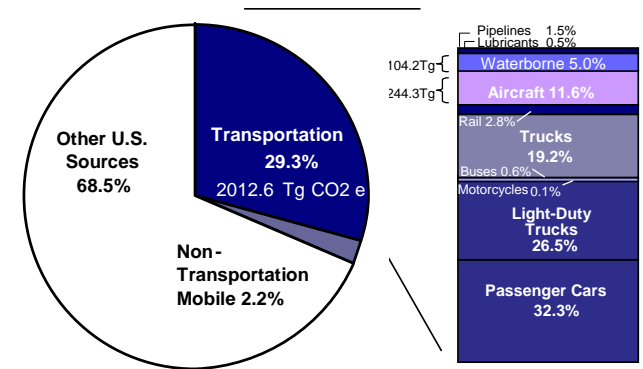


# History of State Inventories cont'd

- First state inventories were completed in the 1990s
- Since then, 44 states have completed inventories, and one more is presently completing an inventory
- State environmental agencies lead the development of the GHG inventories, using the guidance and tools provided by EPA

# Transportation in GHG Inventories – National Level

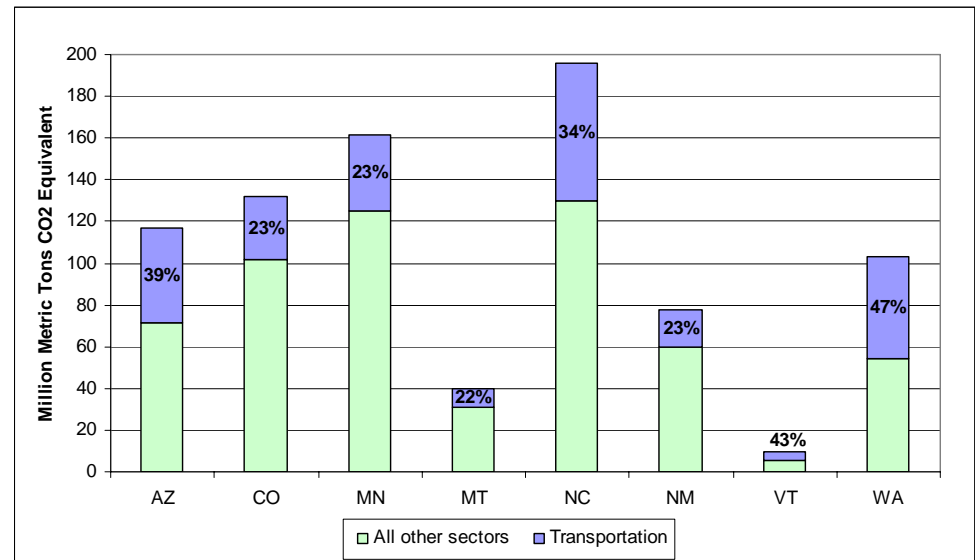
- Transportation sources account for 29% of total U.S. GHGs (28% excluding bunkers)



# Transportation in state inventories

- In 14 states, the transportation sector constitutes the largest source of CO<sub>2</sub> emissions.

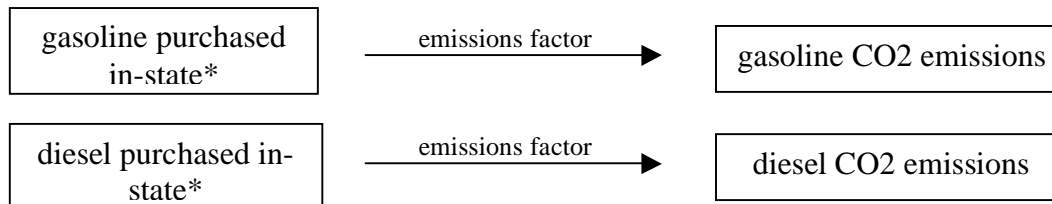
Projected transportation share of GHG emissions in various states, 2010.



Source: various state inventory reports, available through [www.climatestrategies.us](http://www.climatestrategies.us).

# Development of Transportation Emissions Estimates in State Inventories

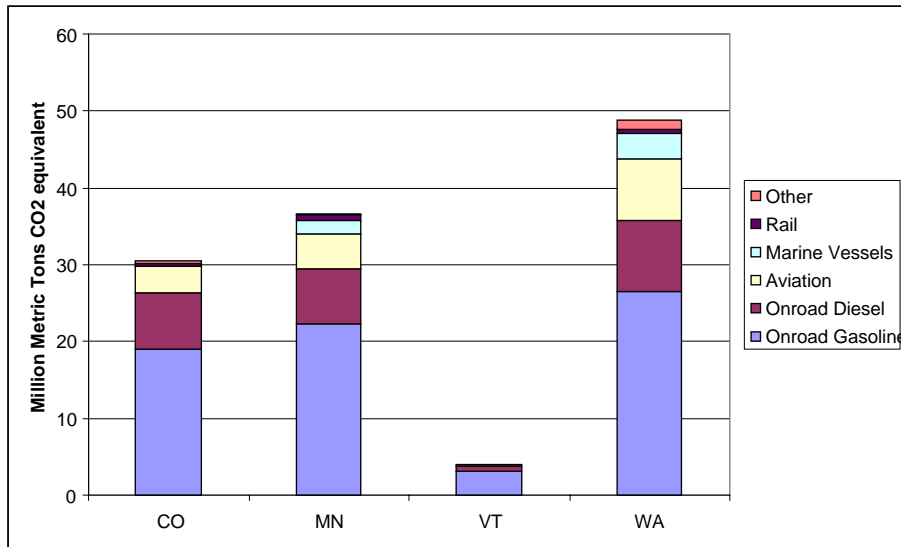
- Top-down approach is the standard (approach followed by EPA's State Inventory Tool)
- State fuel sales used as a proxy for fuel consumption



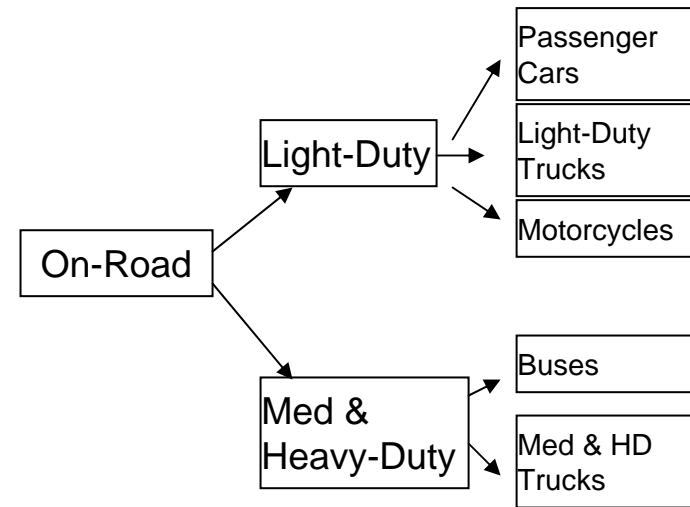


# Characterization of Transportation Sources in State Inventories

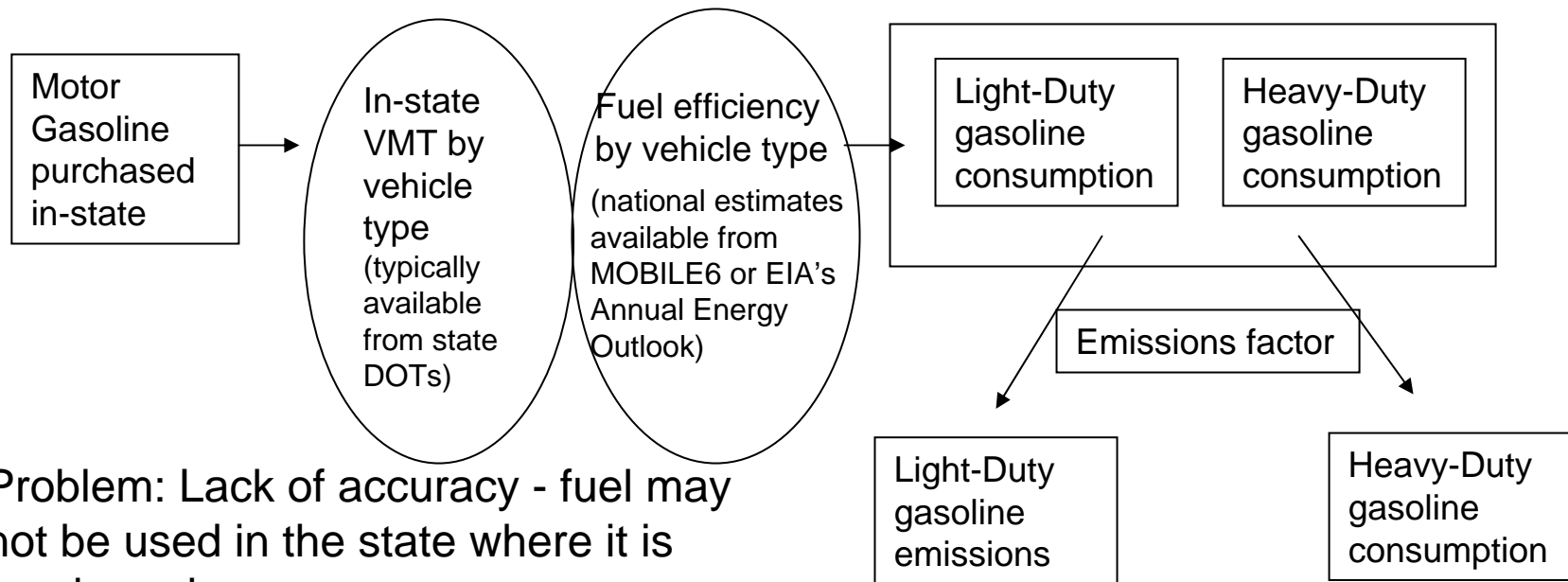
Projected transportation emissions by source in various states, 2010.



Further disaggregation of on-road would greatly improve utility of information

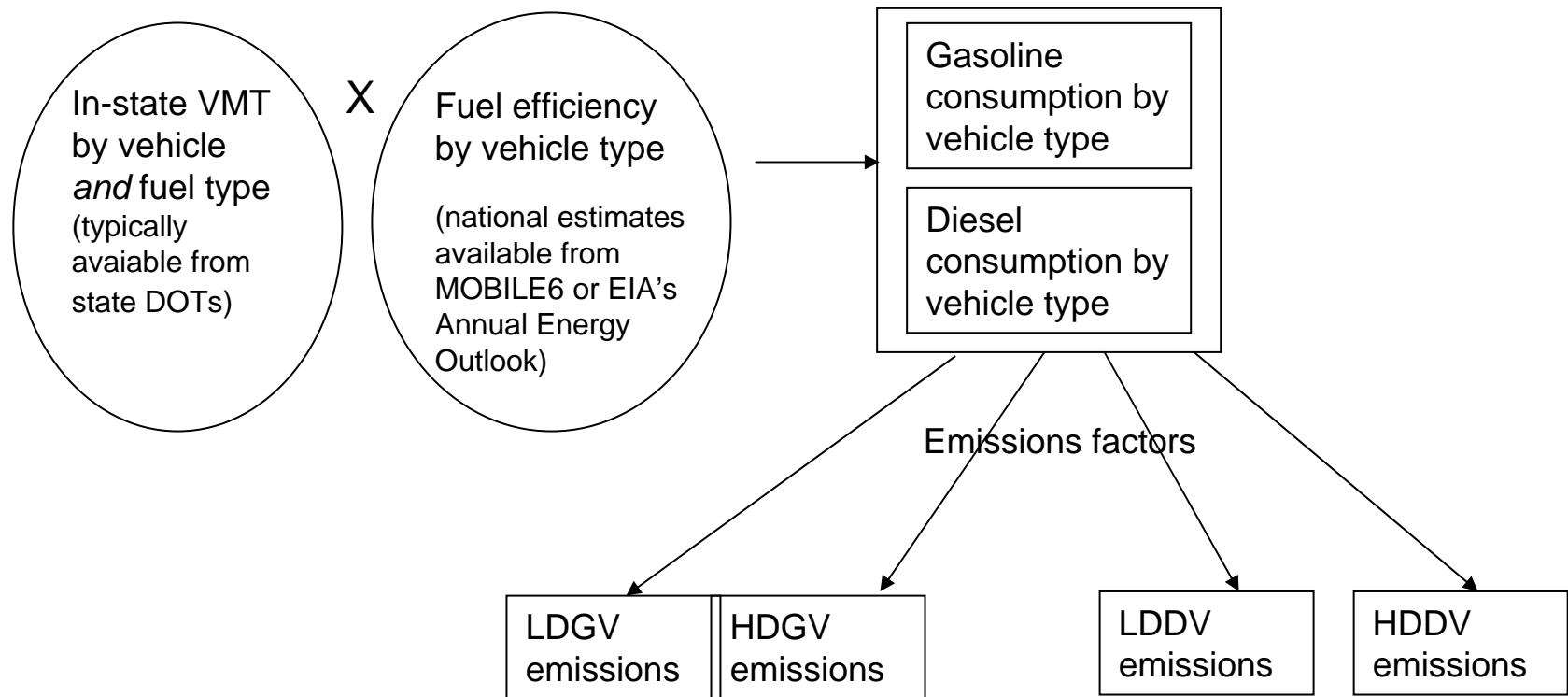


# Disaggregating CO2 by Mode: Top-Down Approach



Problem: Lack of accuracy - fuel may not be used in the state where it is purchased

# Disaggregating CO<sub>2</sub> by Mode: Bottom-Up Approach





# Benefits of Bottom-Up CO<sub>2</sub> Calculations

- Better suited to producing greater level of detail
- Can be used more easily to estimate CO<sub>2</sub> emissions at a range of geographic levels (state, metropolitan area, or municipality)
- Fits naturally with transportation modeling activities, which estimate VMT at the regional or local level

# Challenge of Bottom-Up CO<sub>2</sub> Calculations

- Estimating fuel efficiency, since comprehensive fuel efficiency data is maintained at the national level (California and New York are rare example of a state with its own fuel efficiency estimates)

# Using MOVES for bottom-up estimates

- Best upcoming tool for developing bottom-up GHG emissions estimates (fuel consumption / CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O)
- Simulates actual vehicle drive cycles – provides greater sensitivity to effect of travel conditions (congestion) and travel speeds
- Inputs include vehicle population, fuel efficiency and VMT

# Inventory Challenge #1: Fuel Efficiency and Vehicle Activity Impacts on Fuel Consumption

- **Uncertainties in fuel efficiency**
  - Fuel efficiency depends on fleet characteristics, age of vehicles, and driving conditions
  - Fleet mix and fuel efficiency may vary substantially from national averages
- **Uncertainties in vehicle activity / VMT**
  - MPO estimates generally more reliable than statewide
  - Challenge of reconciling different MPO methodologies and achieving a reliable statewide figure

# Inventory Challenge #2: On-Road Boundary Issues

- Problem arises when fuel sales do not correspond with geographic area of emissions
- Problem most commonly arises because of commuting across state lines
- Common in smaller states and states where metropolitan areas that cross state borders and have substantial cross-state commuter traffic
  - New Jersey: FHWA 19% > MOVES
  - New Hampshire: FHWA 23% > MOVES
- Problem less significant for heavy-duty vehicles because of International Fuel Tax Agreement, which reallocates fuel taxes to states where fuel is used rather than sold



# Addressing On-Road Boundary Issues - New York / New Jersey Example

- New York: VMT had grown by 20 percent from 1990 to 2000 while fuel sales had declined by 4 percent
- New Jersey: fuel sales were overstating implied VMT at an increasing rate
- Solution: New York combined fuel sales in the two states, calculated average fuel economy and then applied these figures to New York VMT to calculate fuel consumption





## Inventory Challenge #3: Non-Road Boundary Issues

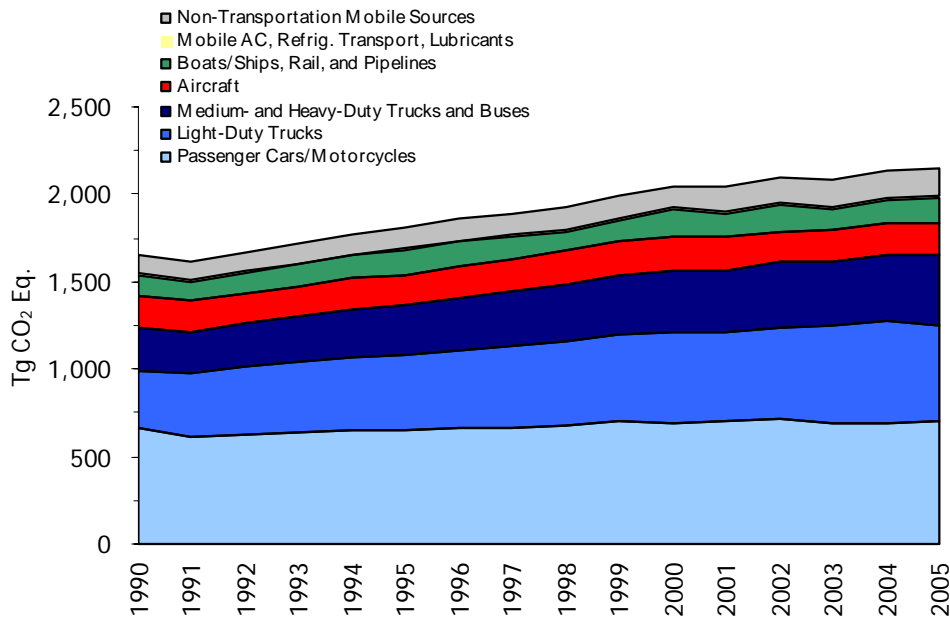
- Aircraft, rail and ships - location of fuel sales versus fuel consumption
  - Impact of major port and airports
- International bunkers
  - Fuel sold to aircraft and ships for international travel
  - According to reporting guidelines, these emissions should be deducted, but states often lack data to make this distinction

# Inventory Challenge #4: Characterizing Upstream Emissions


- Relevance to biofuels analysis
- State Inventory Tool removes CO<sub>2</sub> emissions from ethanol on the basis that ethanol is a carbon-neutral fuel (carbon burned is the same as carbon sequestered when corn is growing)
- Problem: Ignores upstream emissions from the cultivation of corn and the production and distribution of ethanol
- While policy analysis of biofuels will include the impact of production and distribution, the state inventory baselines will not includes these emissions

# Inventory Challenge #5: Characterizing Trends

Change in U.S. GHG Emissions since 1990




- Minimal attention to time-series trends and factors affecting emissions output
- Light-duty sources are treated as largely synonymous with the transportation sector




## Recommendation #1 - Disaggregate emissions by mode / major vehicle category

- More intuitive and provides a more transparent baseline
- Shifts responsibility to state and regional transportation experts, who are most familiar with the best available local datasets



## Recommendation #2: Examine All available datasets and consider developing new datasets

- Will help address sources of error in state fuel consumption estimates
- Will help in the creation of disaggregate emissions estimates
- California developed its own model to forecast fleet mix and fuel efficiency



## Recommendation #3: Consider Implementing Bottom-Up Estimation Techniques

- Better suited to detailed / disaggregate estimates
- More accurate than top-down estimates
- Not presently integrated into standard inventory tools
- MOVES will be valuable when it come on-line

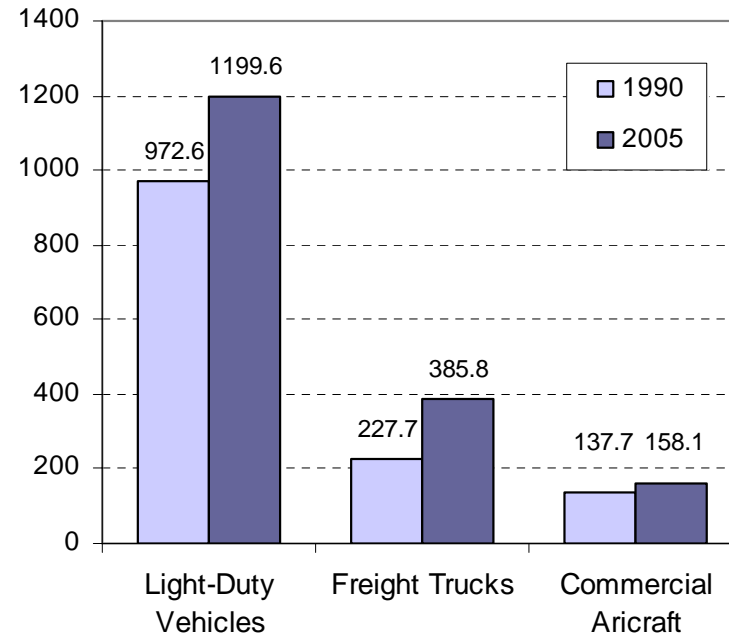
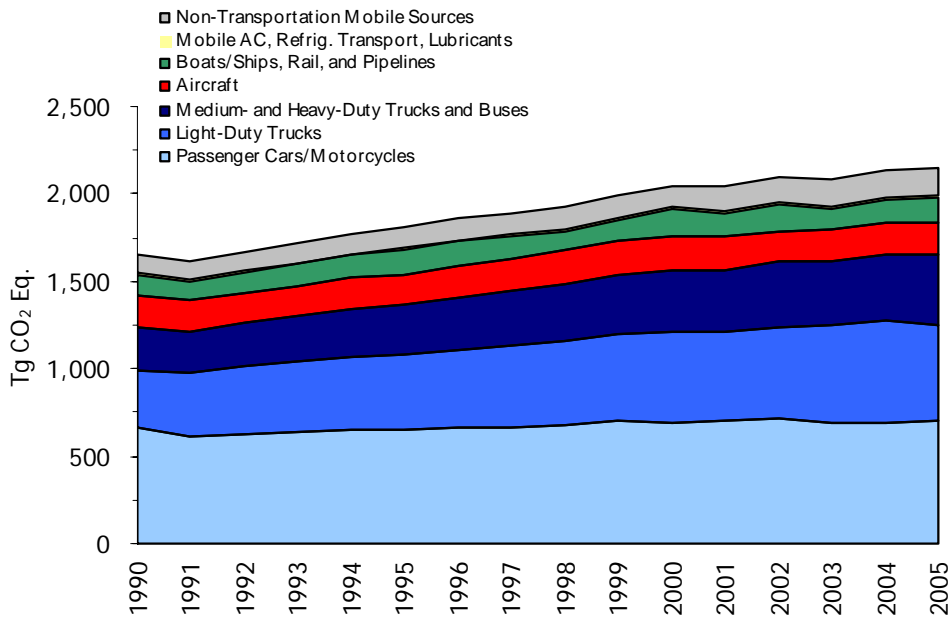


## Recommendation #4: Bridge the Gap between Biofuels Policy Analysis and Inventory Accounting Methods

- Current methods of accounting for biofuels are sufficient at the national level, but create problems for state-level biofuels analysis
- While state policy analysis of biofuels will include the impact of production and distribution, the state inventory baselines will not include these emissions
- Addressing this problem may require federal guidance

# Recommendation #5 : Improve Characterization of Trends and Key Factors to better inform Policy Analysis and Policy Making

Change in U.S. GHG Emissions since 1990





# Inventory Recommendation #6: Providing Sufficient Detail for Policy Analysis

