



# Greenhouse Gas Emissions from Heavy Duty Trucks: Understanding Key Trends, 1990-2008

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Office of Natural Environment

# U.S. GHG Emissions by End-Use Economic Sector, 1990-2008

## 1990-2008

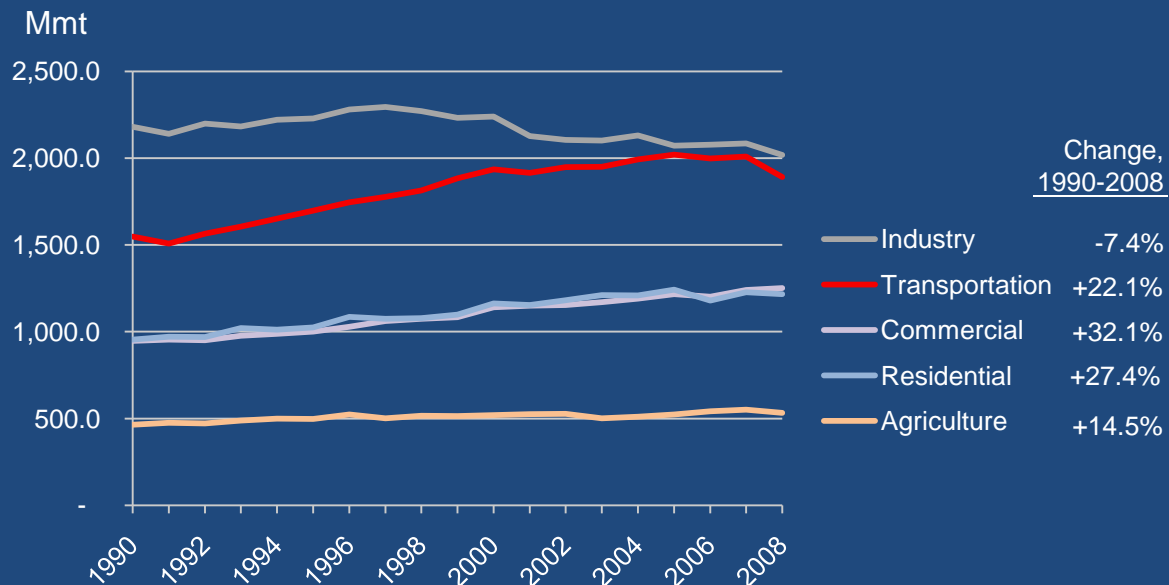
Total U.S. GHGs +13.5%  
 Transportation +22.1%

## 2000-2008

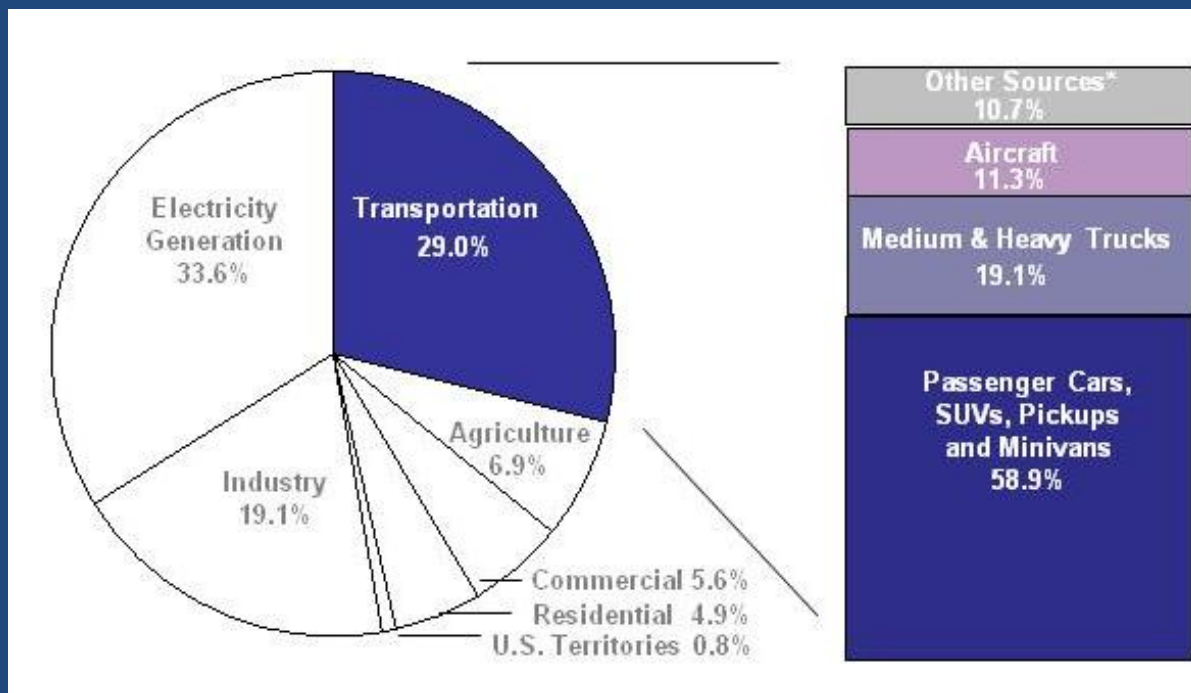
Total U.S. GHGs -1.2%  
 Transportation -2.3%

## 2007-2008

Total U.S. GHGs -2.9%  
 Transportation -5.9%

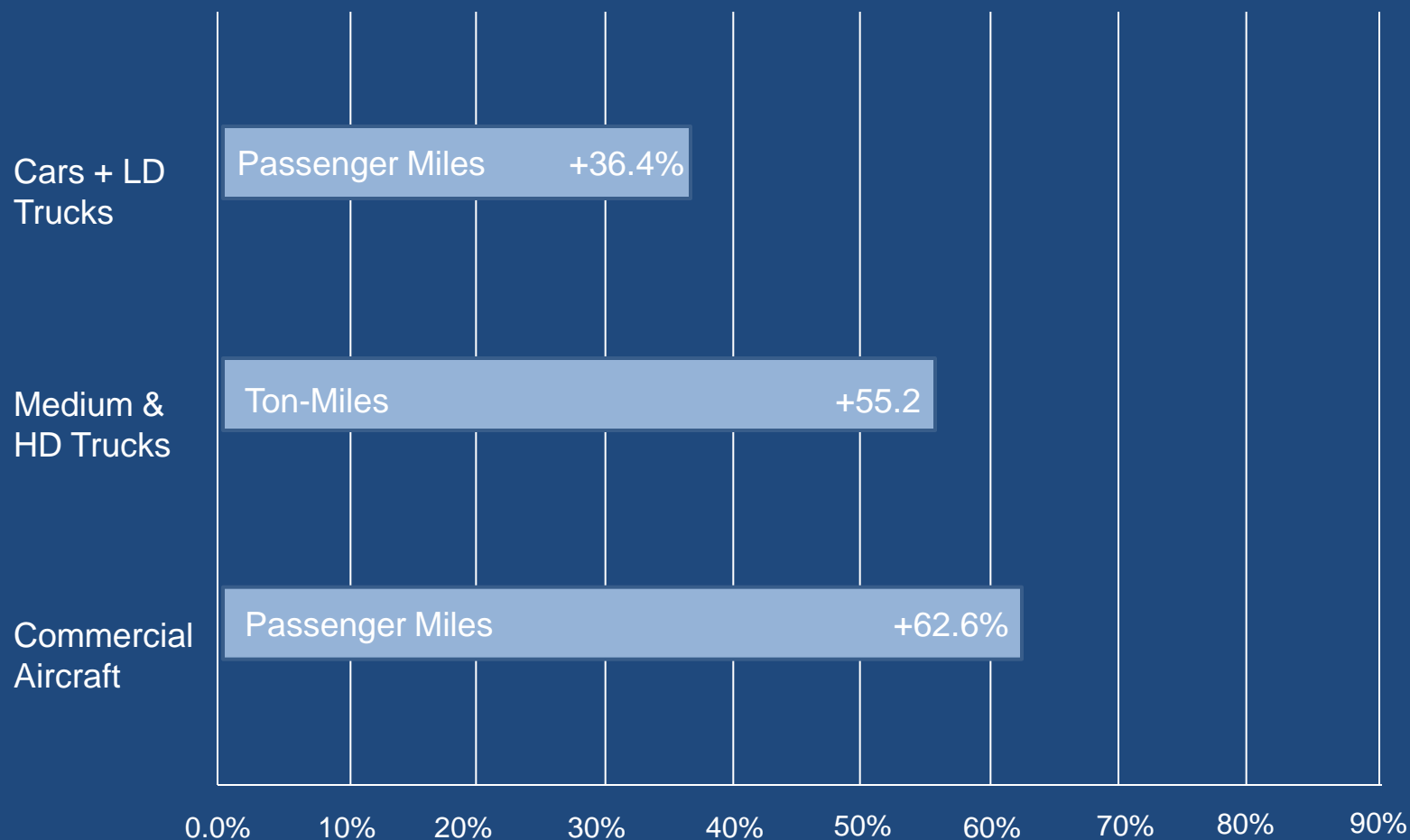


# GHG Emissions by Sector and Source in 2007



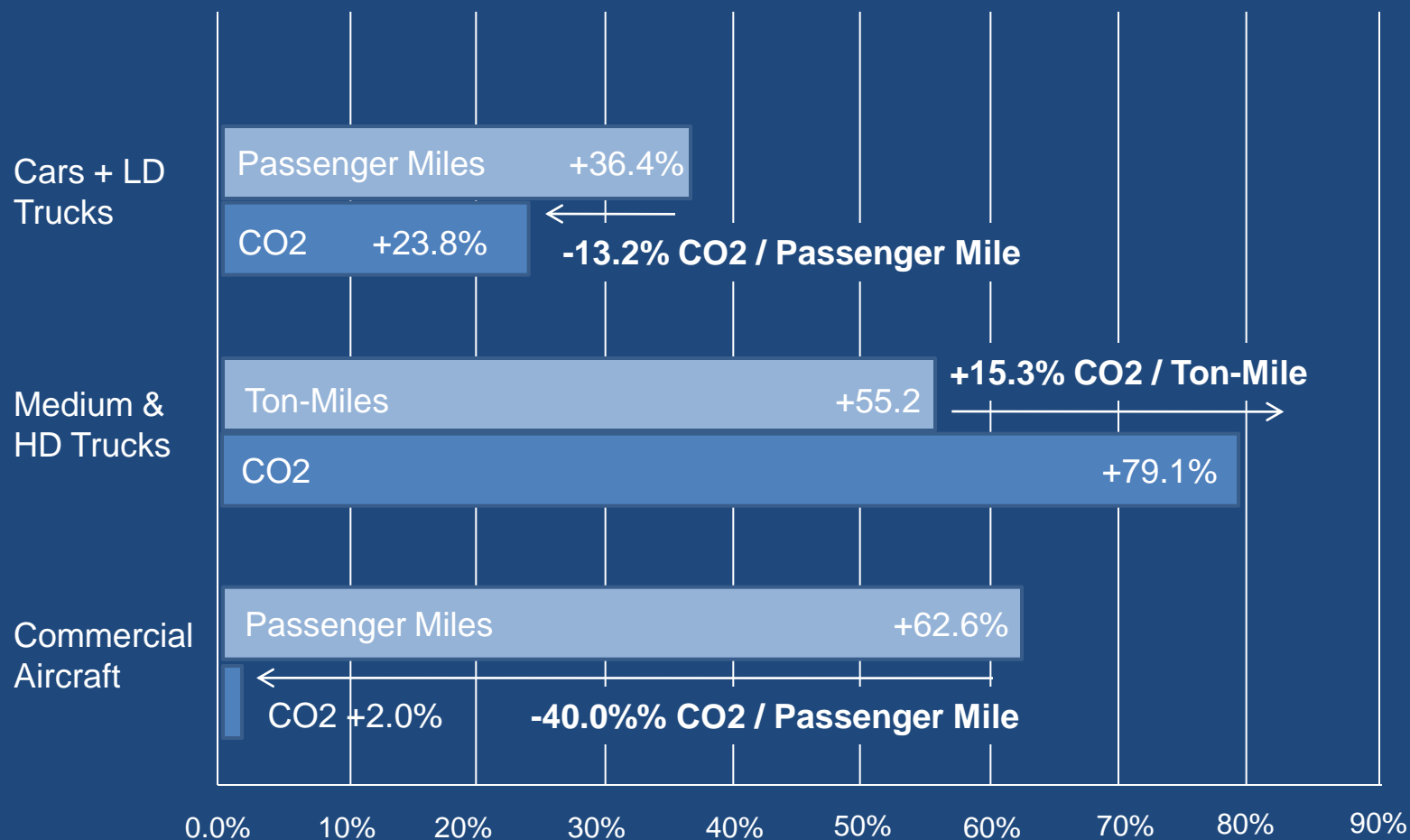
Estimates do not include black carbon, which is produced in significant quantities by trucks

# Change in CO<sub>2</sub>, Activity and Intensity 1990-2007



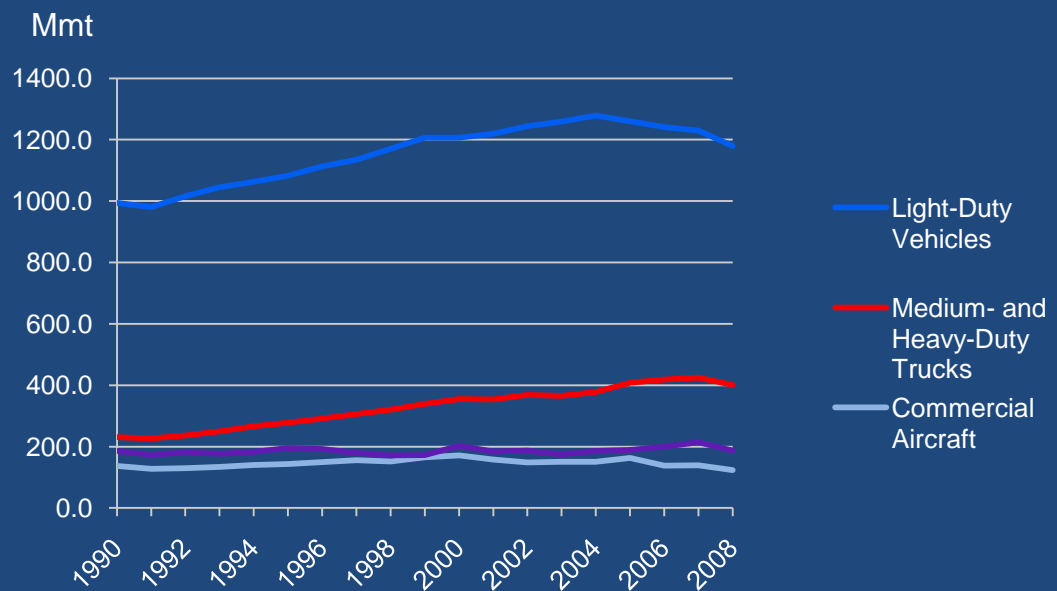
Sources: BTS. *National Transportation Statistics*, table 1-37 (passenger miles) and 1-46b (ton-miles); EPA *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2008*, table 2-15.

# Change in CO2, Activity and Intensity 1990-2007



Sources: BTS. *National Transportation Statistics*, table 1-37 (passenger miles) and 1-46b (ton-miles); EPA *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2008*, table 2-15.

# Transportation GHGs by Major Transportation Mode, 1990-2008



**1990-2008**

<b>Transportation</b>	<b>+22.1%</b>
- LD Vehicles	+18.7%
- Med & HD Trucks	+73.6%
- Commercial Aircraft	-9.8%

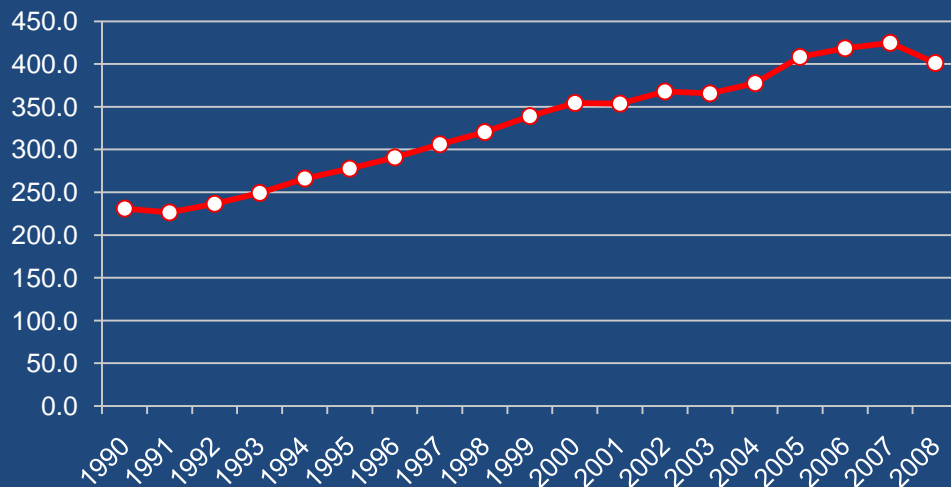
**2007-2008**

<b>Transportation</b>	<b>-5.9%</b>
- LD Vehicles	-4.1%
- Med & HD Trucks	-5.6%
- Commercial Aircraft	-11.5%

Source: EPA *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2008*, Table 2-15

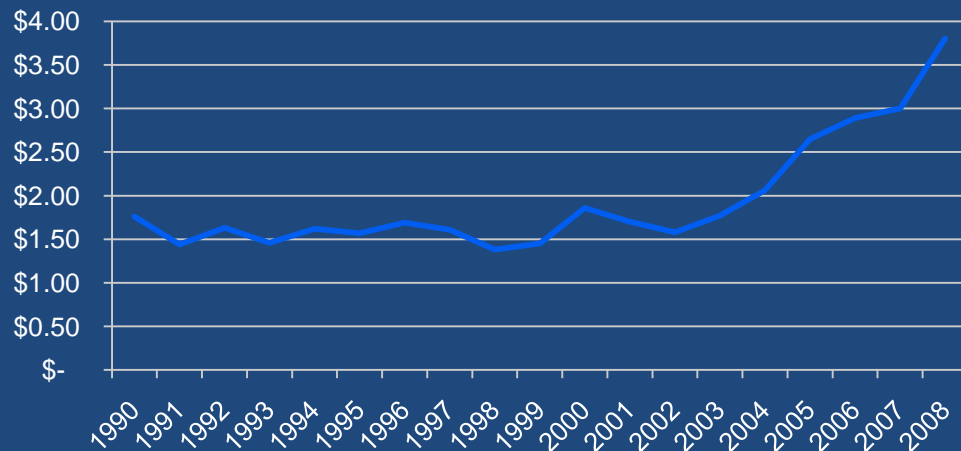
# Truck GHGs and Diesel Fuel Prices

Medium- and Heavy Duty Truck GHG Emissions



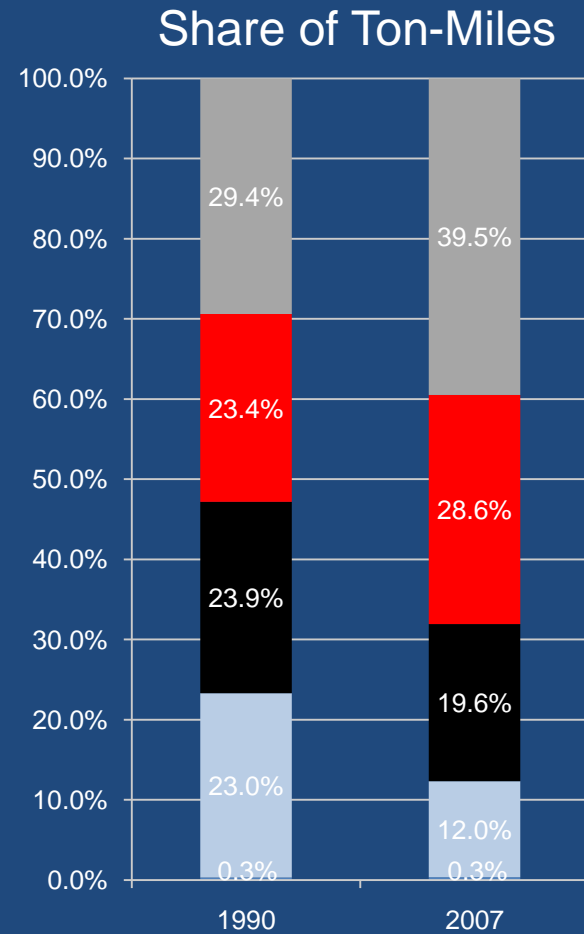
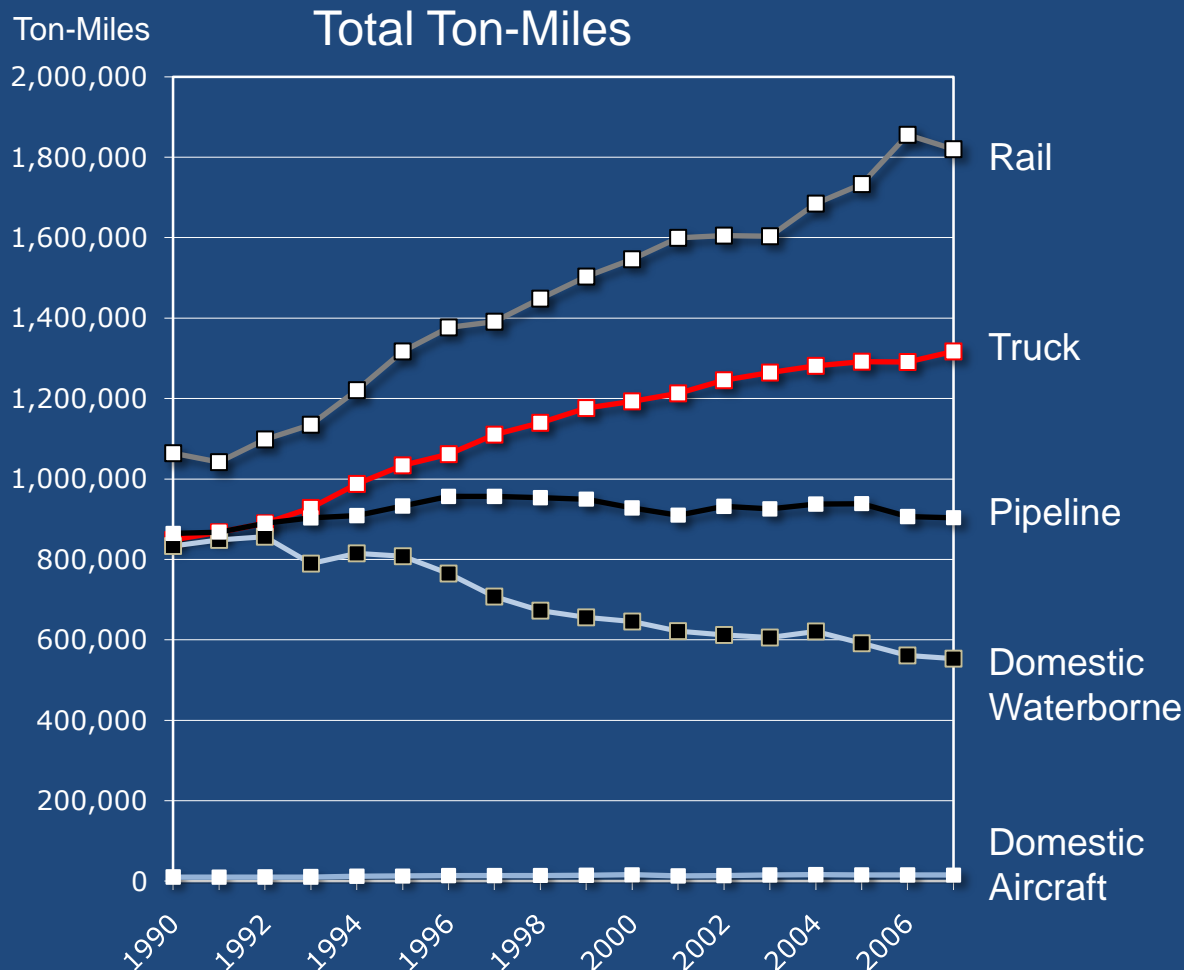
- Truck GHG emissions continued to rise from 2004 to 2007 despite rapidly increasing diesel fuel prices

Diesel Fuel Price (Real 2008 Dollars)



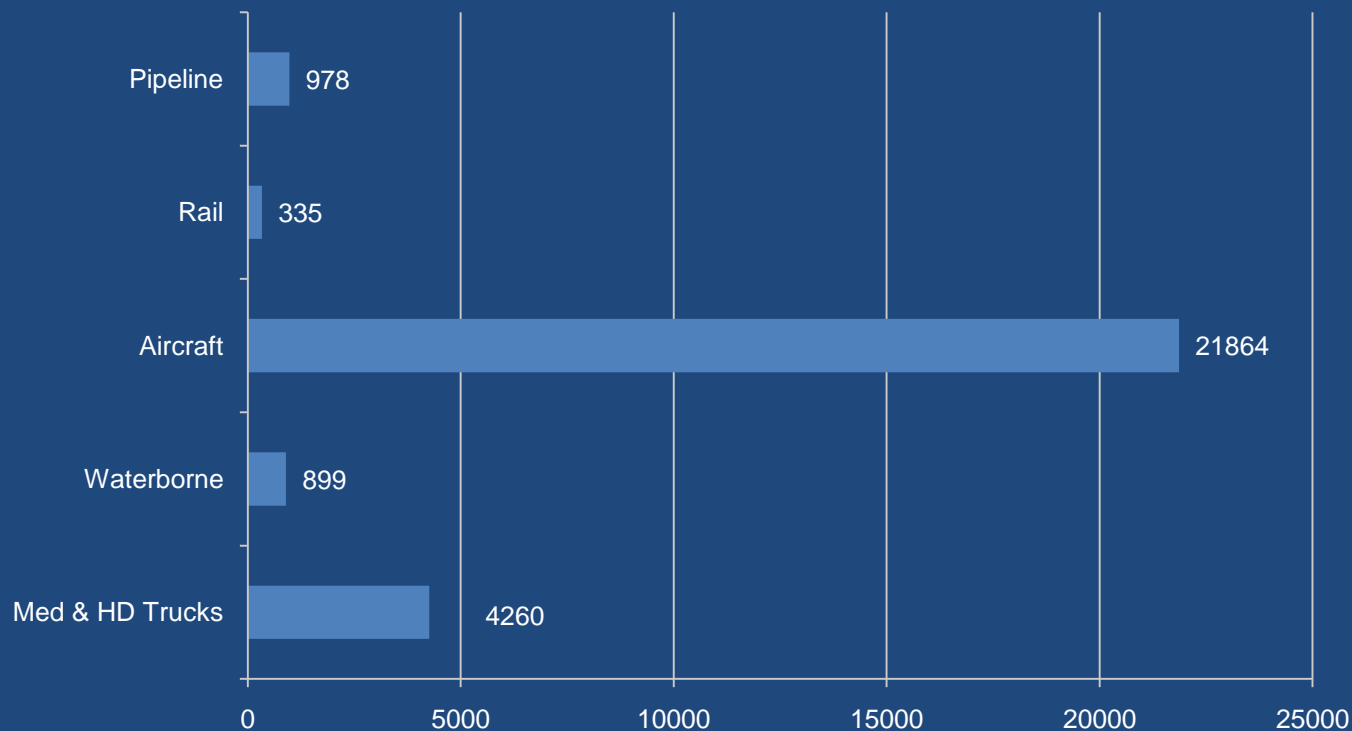
Source: EPA *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2008*, Table 2-15 ; Transportation Energy Data Book

# Ton-Miles by Mode, 1990-2007



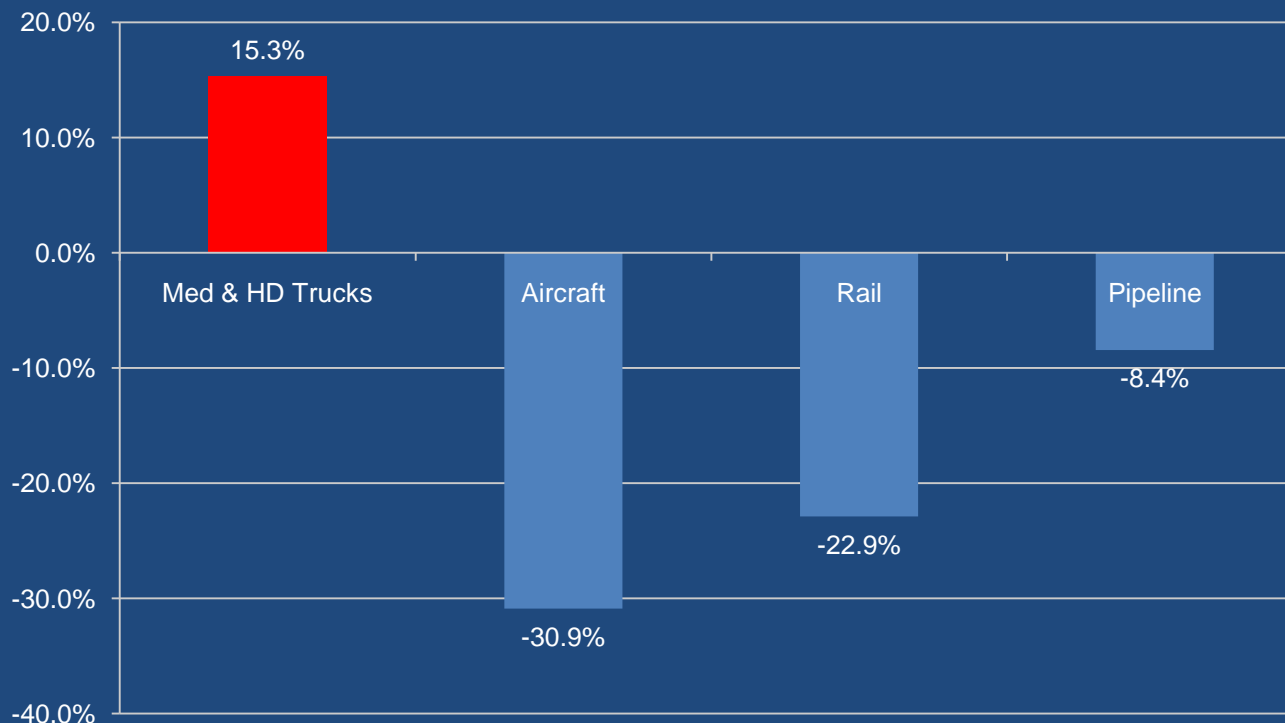
Source: BTS *National Transportation Statistics* , table1-46b.

# Freight Energy Efficiency in 2007 (BTU / Ton-Mile)



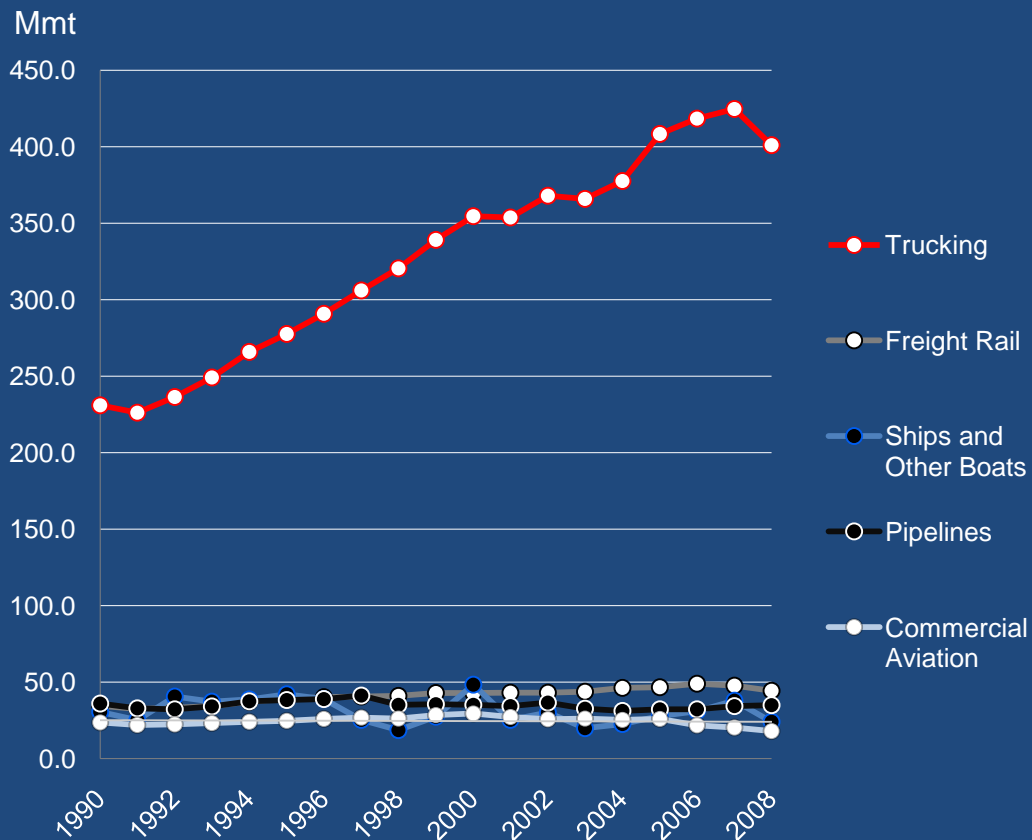
Sources: Energy consumption estimates derived from EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2008, with the exception of pipeline estimates, which were taken from the Transportation Energy Data Book. Freight ton-mile estimates from BTS, National Transportation Statistics table 1-46b.

# Change in Freight Energy Intensity (BTU/Ton-Mile), 1990-2007



Sources: BTS Table 1-46b and Transportation Energy Data Book Tables 2-7 and 2-8; the most recent waterborne calculations are for 2006; aircraft freight fuel consumption estimates calculated by multiplying total domestic fuel consumption by the share of total

# GHGs by Freight Mode, 1990-2008

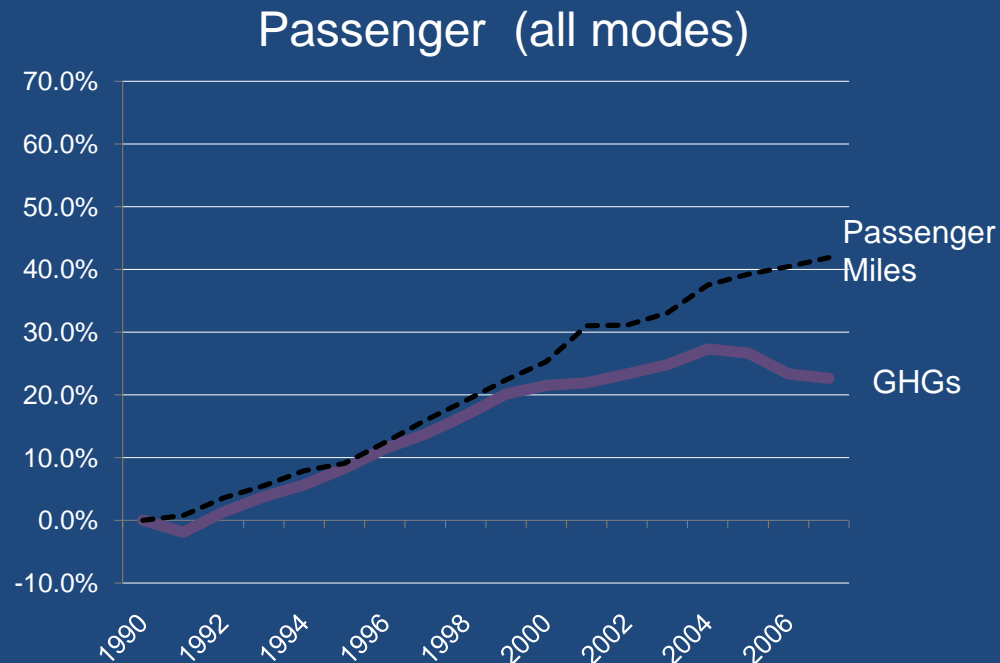
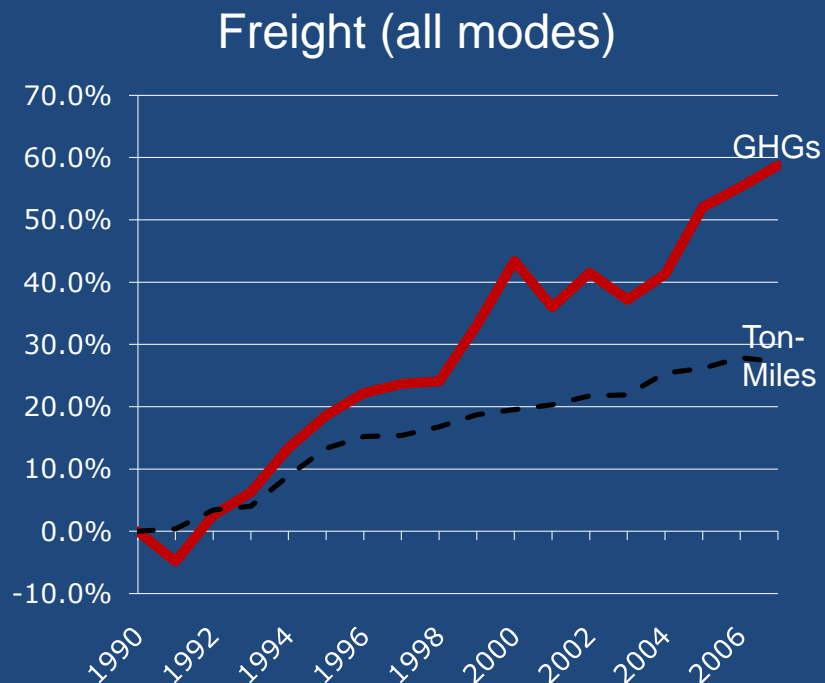


## 1990-2008

<b>All Freight Sources</b>	<b>+46.8%</b>
-Med & HD Trucks	+73.6%
-Freight Rail	+28.5%
-Ships and Boats	-21.1%
-Pipelines	-3.2%
-Aviation	-24.1%

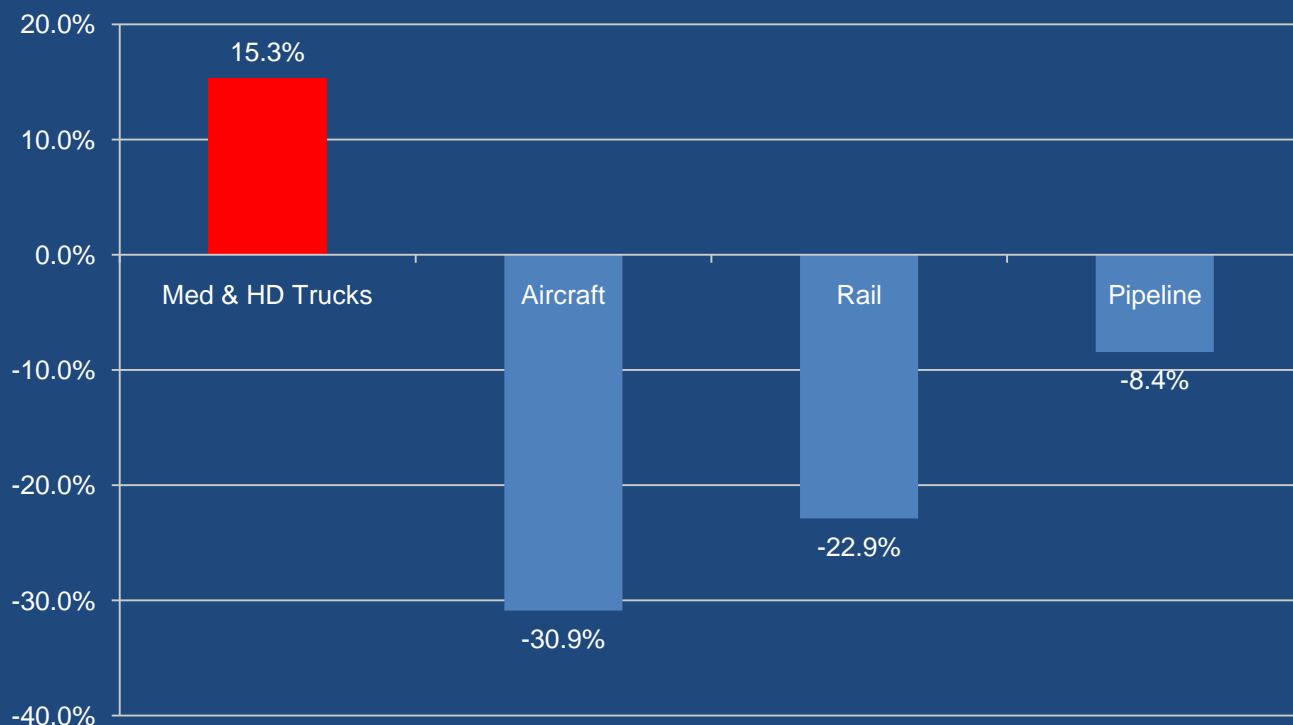
# GHGs and Activity, 1990-2007

## Freight and Passenger



# How Do We Explain the Apparent Decline in Truck Energy Efficiency?

(BTU/Ton-Mile), 1990-2007



Sources: BTS Table 1-46b and Transportation Energy Data Book Tables 2-7 and 2-8; the most recent waterborne calculations are for 2006; aircraft freight fuel consumption estimates calculated by multiplying total domestic fuel consumption by the share of total

# Vehicle Load Factors

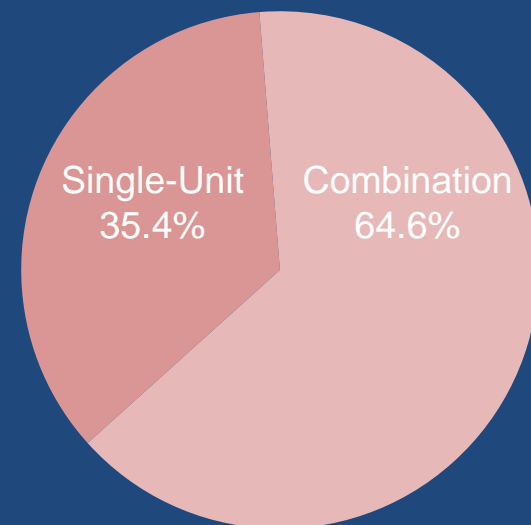
- ◉ Without updated VIUS data, we lack current estimates of vehicle load rates
- ◉ Overall load rates appear to have remained roughly constant, since truck vehicle miles and ton-miles have increased at about the same rate since (~55% since 1990)
- ◉ Load rates may have changed slightly by truck type
  - Earlier VIUS data suggested an increase in number of empty miles traveled by combination trucks (result of globalized trade)
  - Potential increase in load factors for urban delivery vehicles

# Activity by Truck Type

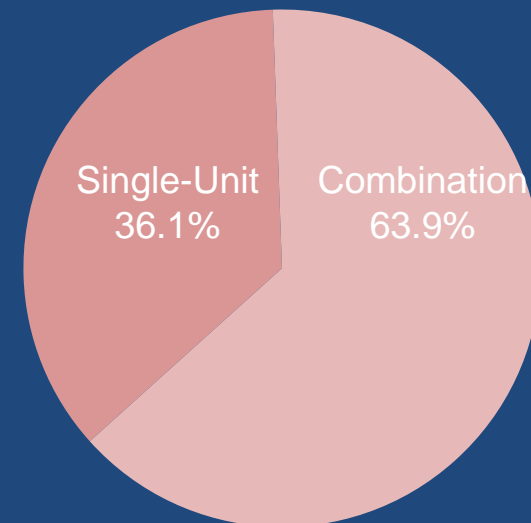
- Single-unit trucks have a higher energy intensity per ton-mile than combination trucks
- However, their share of overall truck VMT has not substantially increased since 1990

Share of VMT

1990



2007



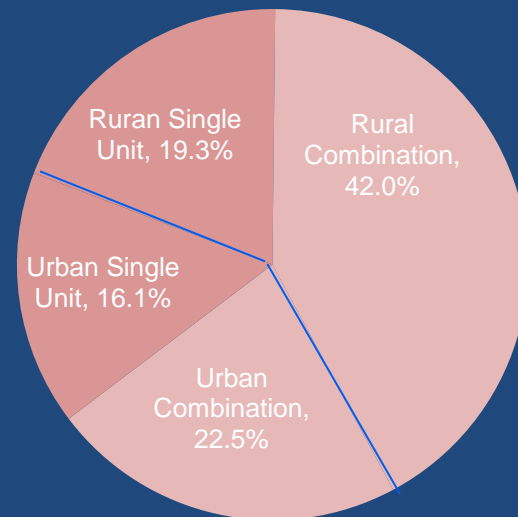
Sources: Highway Statistics , Summary to 1995 and 2008

# Activity by Truck Type and Highway Category

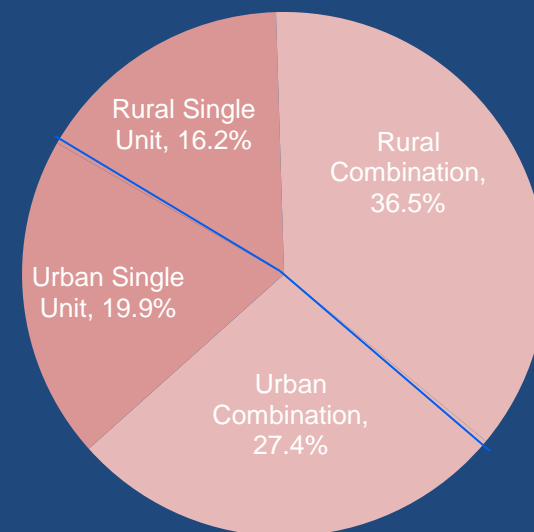
- More truck activity occurred in congested conditions
  - A greater share of VMT was in urban areas
  - Potential spreading of congestion outside urban areas?

1990

Share of VMT



2007



Sources: Highway Statistics , Summary to 1995 and 2008

# Mechanical Factors to Explain the Decline in Trucks' Measured Energy Efficiency

- ⦿ Not vehicle age, since the average truck seems to be getting newer (5.4 years in 2002, versus 6.4 years in 1992)
- ⦿ Demand for more powerful engines?
- ⦿ Fuel economy penalty from implementation of NO<sub>x</sub> and PM control devices?



# For More Information

Federal Highway Administration Climate Change Website:

<http://www.fhwa.dot.gov/hep/climate/index.htm>

US DOT Transportation and Climate Change Clearinghouse:

<http://climate.dot.gov/index.html>

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FHWA Office of Natural and Human Environment  
Sustainable Transport and Climate Change Team