

AN ASSESSMENT OF GHG EMISSIONS FROM THE TRANSPORTATION SECTOR

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Introduction

- Transportation sector accounts for 27% of total GHG emissions with the greatest annual growth
- “Inventory report” required under UNFCCC->data organized by GHG, fuel type but no detailed sectoral analysis
- More detailed inventory for transportation sector ->useful for transportation planners/policymakers when evaluating effective reduction strategies

Methodology for Estimating GHG Emissions

- CO₂ emissions estimated based on the carbon content of fuels and fuel consumption by fuel type and vehicle type (=top down approach)
- CH₄ and N₂O emissions estimated based on activity-level data (e.g., VMT, fuel consumption) and emission factors (=bottom-up approach)
- HFC emissions estimated based on the number, size, and leakage rate of coolant equipment

Overview of Analysis

- The paper describes transportation GHG emissions from the following perspectives:
 - By the GHG “intensity” -> how emissions from transportation sector have changed over time in comparison to economic activity (e.g., GDP)
 - By transportation mode, trip purpose, and economic activity (e.g., freight, commodity carried, or public transport)
 - Within the context of the full lifecycle of transportation emissions

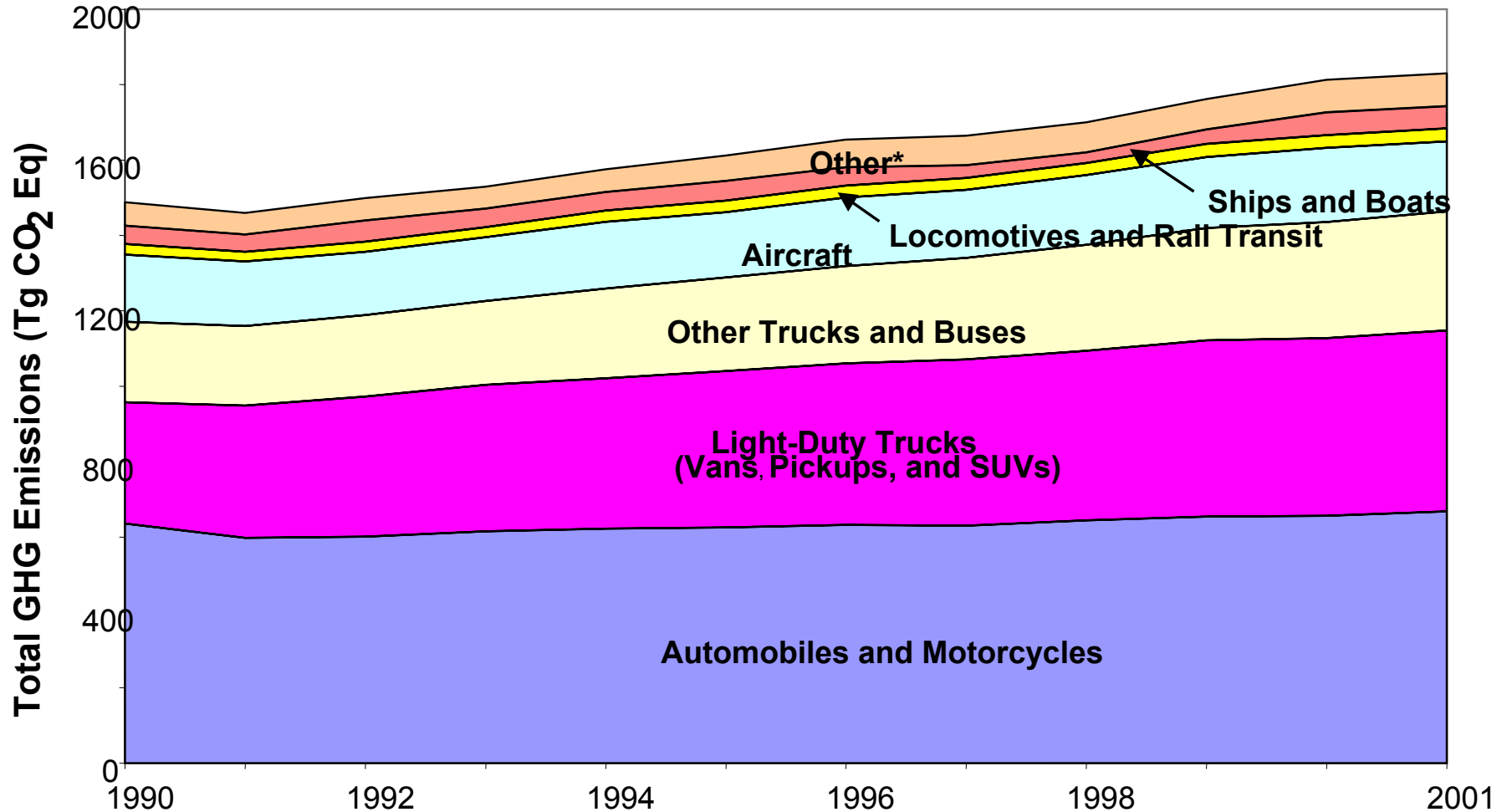
Transportation GHG and Economic Trends

- GHG intensity = how much is emitted per unit of economic activity (GDP)
- Comparison of GHG intensity for the transportation sector and for the US economy between 1990 and 2001:
 - GHG intensity is decreasing since GDP grew faster than GHG emissions, although GHG emissions are increasing relative to population growth
 - Transportation has a much higher GHG intensity but it's decreasing faster than the overall intensity
 - Transportation GHG intensity may be overestimated since GDP doesn't account for activities that are not part of the formal economy

Transportation Trends by Modes

- Transportation emissions are steadily increasing but not consistently across modes
- Highway vehicle emissions have gone up by 25% from 1990-2001, mainly due to growing emissions in the LD truck (vans, pickups, SUVs) and MD and HD truck categories
- Aviation emissions are nearly flat, but the increase is nearly 13% if military aircraft are excluded
- Contribution from mobile air conditioners and refrigerated transport increased rapidly as the HFCs have been phased in to replace CFCs

GHG Emissions by Vehicle Type



- Overall increase of 22%, mainly due to LD, MD and HD trucks
- Highway vehicles ~ 80% and LD ~ 61% of the total transportation emissions

Trends by Trip Purpose (LD vehicles)

(based on 1995 survey)

Trip Purpose	Percent of Vehicle Trips	Percent of VMT/Emissions
Earning a Living	27	38
Family/Personal Business	50	36
Social/Recreational	18	23

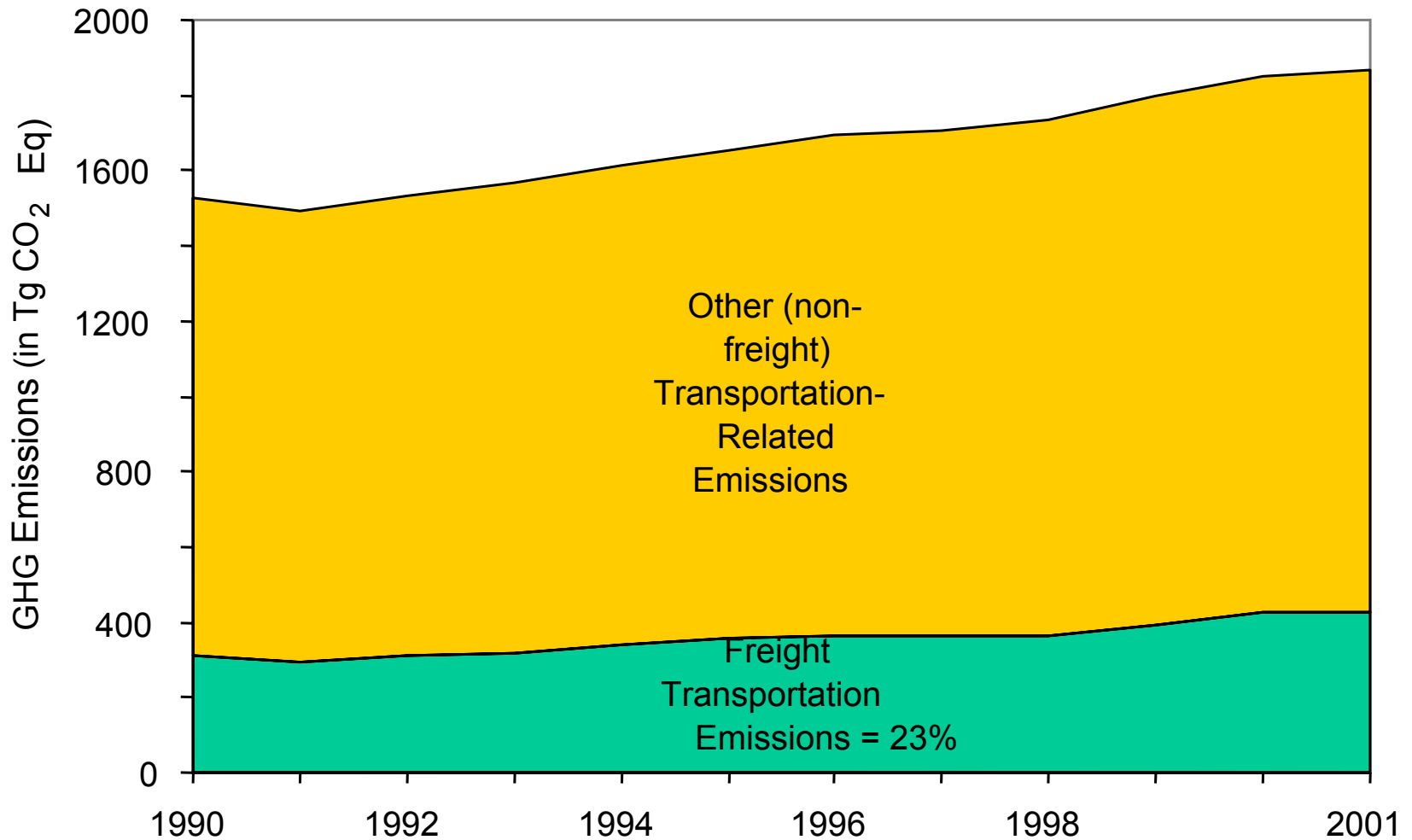
Trends by Trip Purpose (LD vehicles)

- Per-household VMT/emissions increased by 15% from 1990 to 1995:
 - mainly due to increased VMT associated with commuting to/from work
 - More workers per household
 - Length of work trips increased
- VMT associated with family and personal trips basically stable -> errands are fairly consistent in their frequency and destination

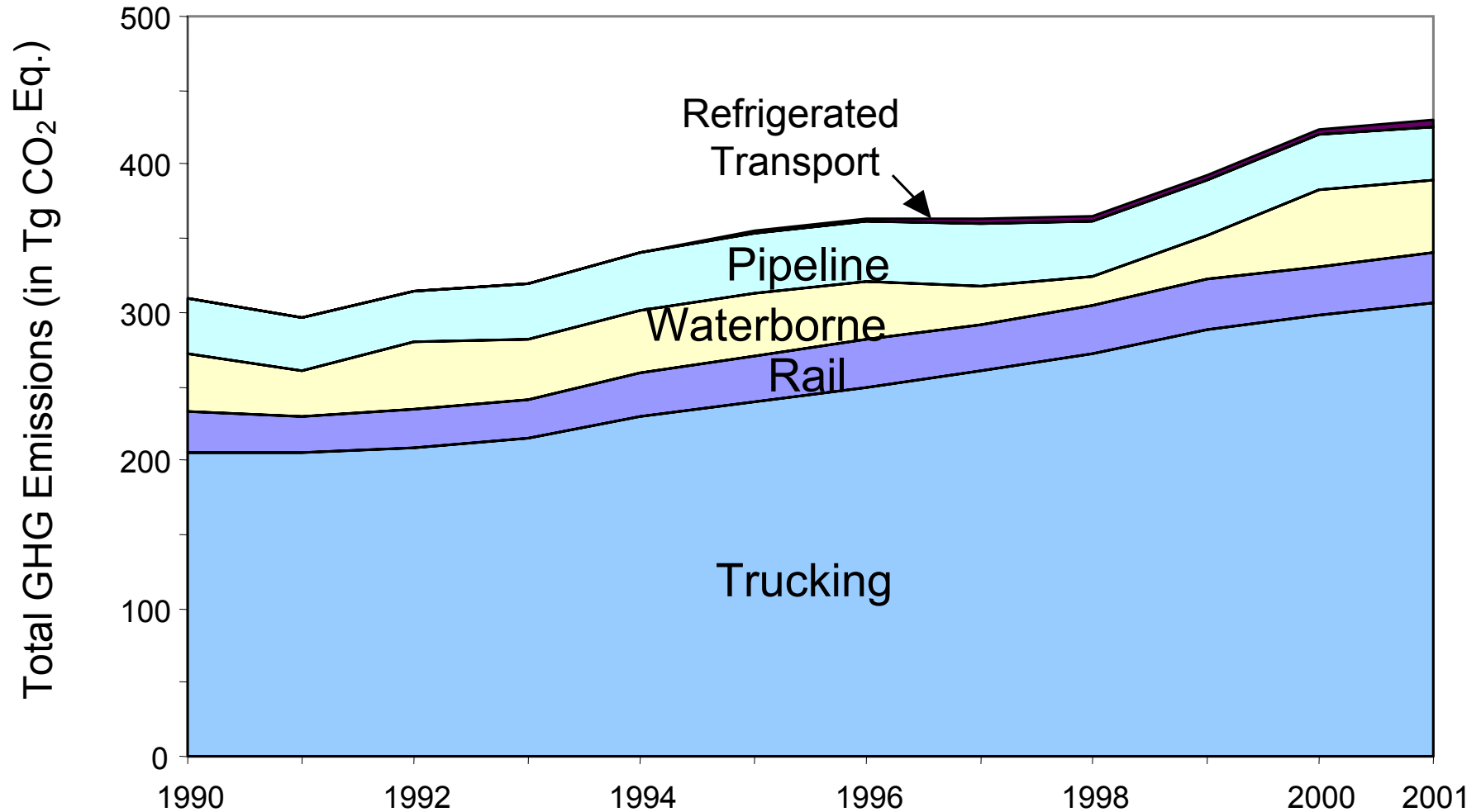
Long Distance Personal Travel (trips over 100 miles)

- Approximately three-quarters of household trips were taken in personal use vehicle (car, truck, van), not aircraft
- The major trip purpose was business trips and “visit friends/relatives” category

Freight Contribution to Total Transportation GHG

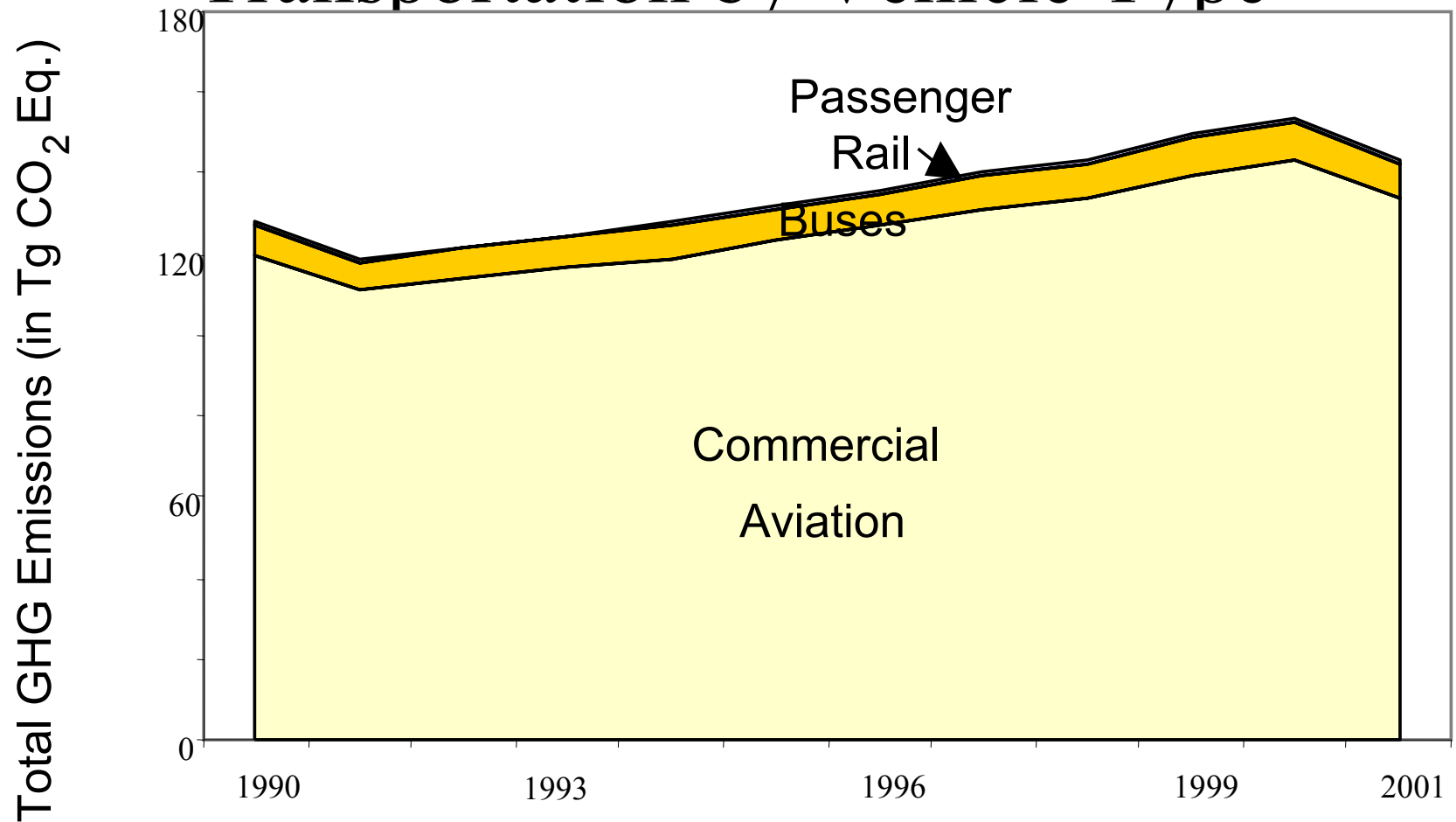


GHG Emissions from Freight Transportation



- Overall increase of 37%; trucking represents 71% and increase of 46%;

GHG Emissions from Public Transportation by Vehicle Type



- Represent only 8% of the total transportation emissions in 2001

Lifecycle Perspective

- Transportation lifecycle GHG emissions
 - Direct (from tailpipe)
 - Indirect (upstream sources)
 - Fuel cycle = Production, refining, and distribution of fuels
 - Vehicle manufacture lifecycle=production of vehicle itself and its materials, vehicle distribution
 - Infrastructure lifecycle= construction and maintenance of infrastructure

Lifecycle Analysis (cont'd)

- Fuel cycle
 - E.g., for gasoline GHG are about 24-27% of end-use emissions however it varies dramatically from fuel to fuel
- Vehicle manufacture lifecycle
 - GHG are about 15-20% of end use emissions -> mostly from the lifecycle of materials
- Infrastructure lifecycle
 - No data yet-work in progress

Lifecycle Issues

- Presented estimates are very specific to the particular fuel or vehicle type analyzed and cannot be generalized over the whole transportation sector
- Lifecycle helps illustrate the role of transportation sector in overall GHG emissions but the numbers should not be used for an explicit sectoral inventory or for sector level policy analysis

Conclusions

- Transportation GHG intensity compared to the U.S. economy as a whole
 - Transportation GHG intensity is higher but it's decreasing faster
 - May be overestimated since many transportation-related activities are not accounted for in GDP
- Transportation trends by modes
 - Emissions increasing steadily but not consistently across all the modes -> mainly due to growth in LD trucks for personal use and HD trucks for freight

Conclusions (cont'd)

- Transportation trends by trip purpose
 - “earning a living” is the biggest contributor and cause of an increase between 1990-1995 (->more workers/longer trips)
 - For long distance travel, about $\frac{3}{4}$ of trips taken in personal vehicles and the main purpose was pleasure
- Lifecycle analysis
 - Despite the associated uncertainty, it can illustrate potential overall impact of GHG from transportation sector which is helpful for mitigation strategies