U.S. Greenhouse Gas Emissions in the Transportation Sector

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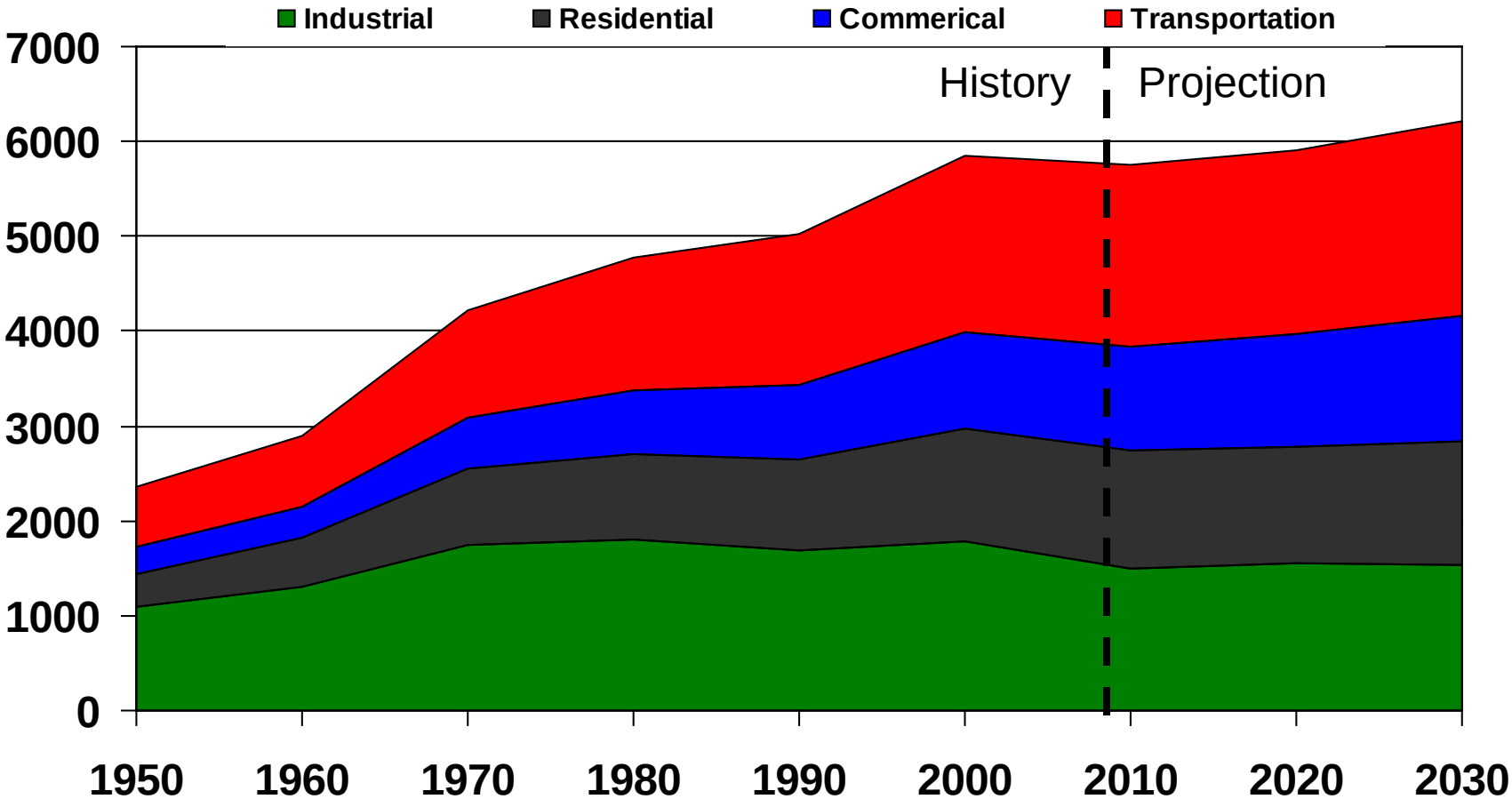
Methodology

- Annual Energy Outlook (AEO) results are based on the National Energy Modeling System (NEMS)
- NEMS consists of a number of supply, demand, and conversion modules.
- The results I present today are based on the transportation model; however, many inputs are base on other NEMS modules. Important inputs include: macroeconomic drivers, fuel prices, etc.
- The transportation module attempts to represent both manufacturer and consumer behavior, which is based in historical data.
- As such, the model projects a continuation of current policy and market behavior.
- Policies that affect consumer behavior, infrastructure, etc., can change outcomes.
- Two important inputs to the transportation model are macroeconomic activity and petroleum prices. In these reference case projections:
  - Oil prices are projected to reach almost $190 per ($2007) barrel in 2030.
  - U.S. economic activity, as measured by GDP is projected to grow by about 2.4%

U.S. Greenhouse Gas Emissions by Sector
(Million Metric Tons Carbon Dioxide Equivalent)

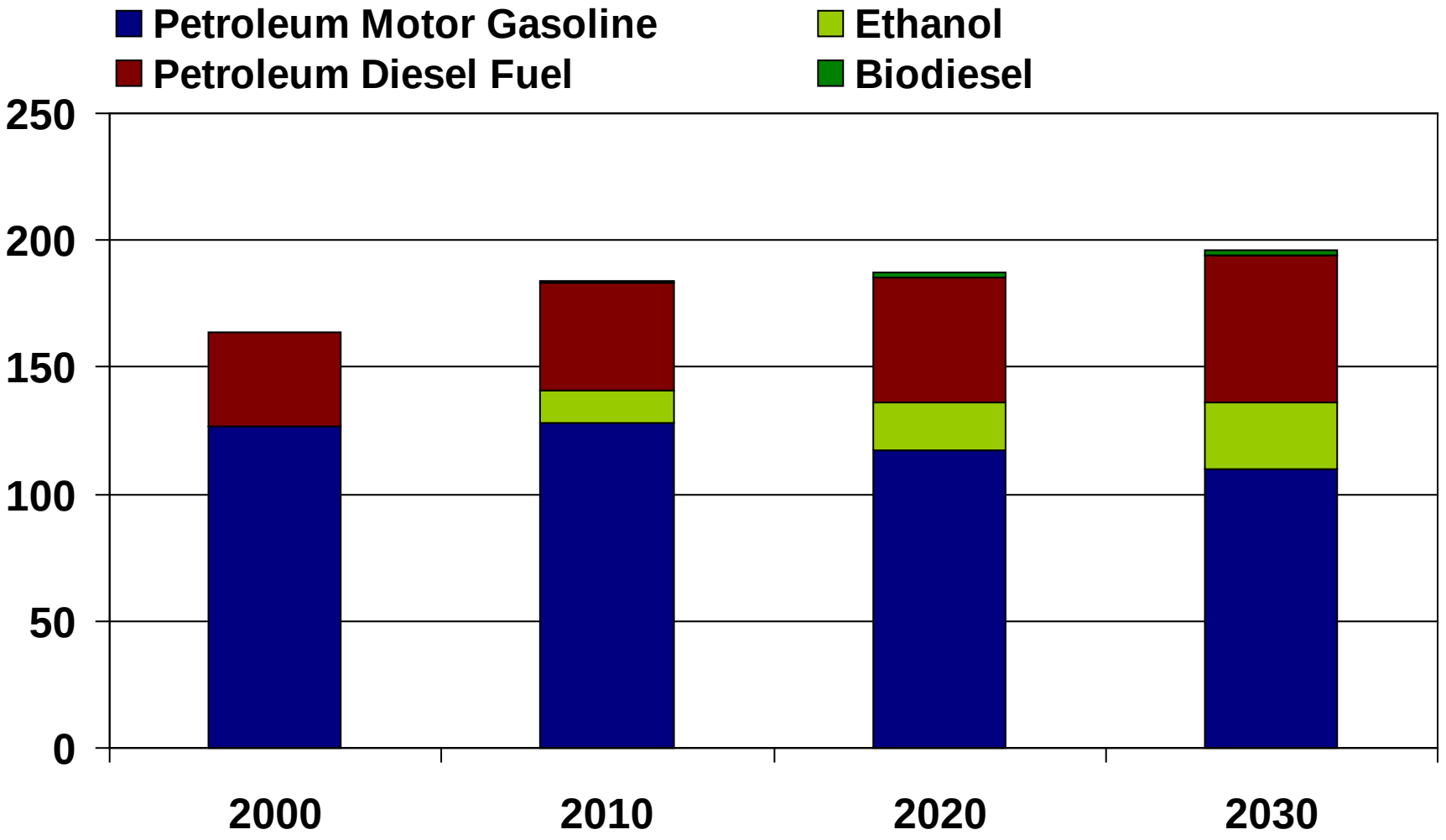


Sources: History: *Annual Energy Review*, 1960-1980 *State Energy Data Report*; 1990-2000 *Emissions of Greenhouse Gases in the United States 2007*
Projection: *Annual Energy Outlook 2009* Updated Reference Case d041409a

Greenhouse Gas Emissions and Biofuels in the National Energy Modeling System

- Ethanol and biodiesel are assumed to be GHG neutral in transportation end use
- Vehicle emissions from ethanol and biodiesel are assumed to be offset by the growing of feedstock crops
- NEMS *does* count emissions from crop and fuel production in the industrial sector
- Biofuel production is very important to projecting GHG emissions in the transportation sector.

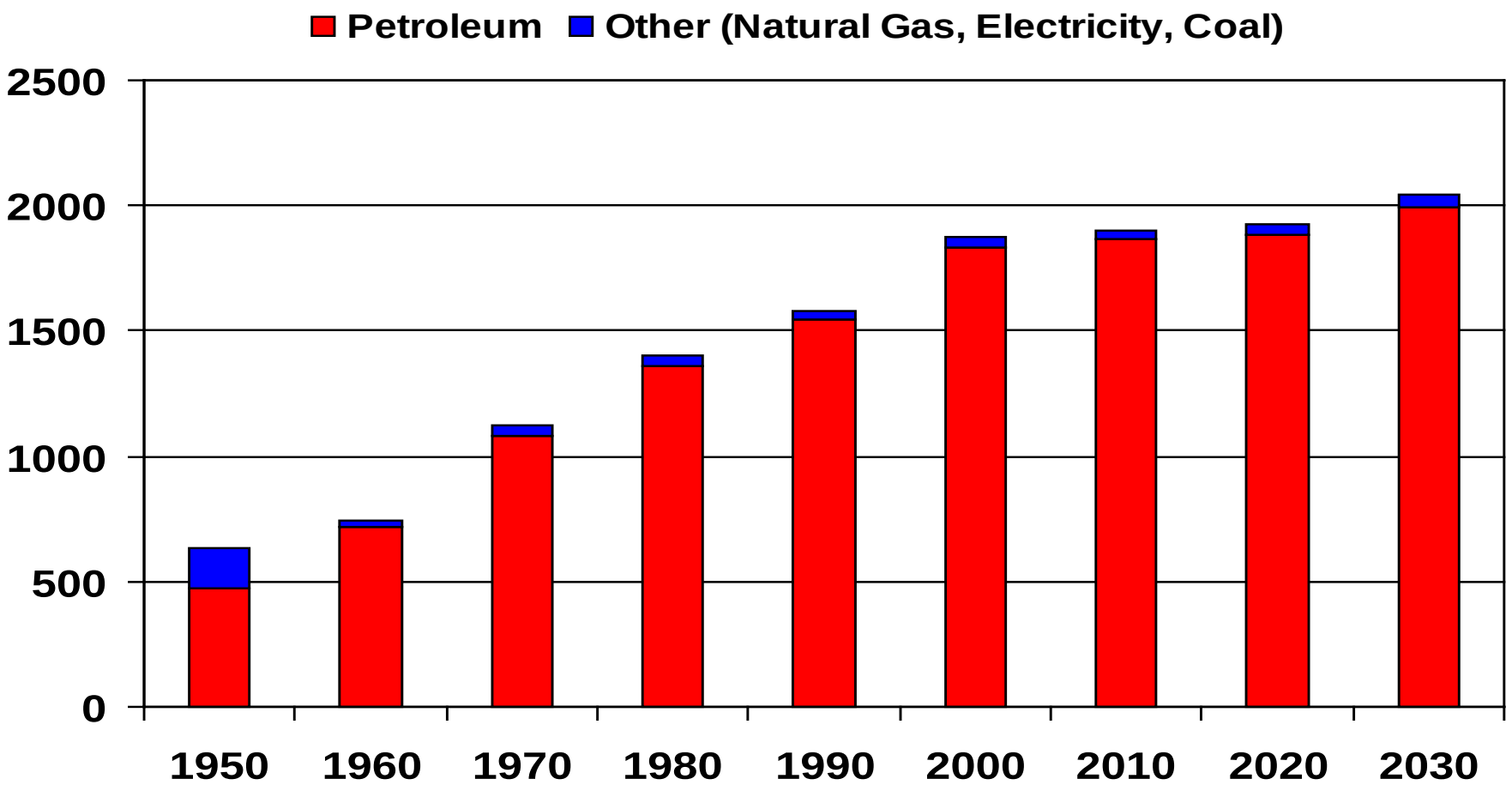
Petroleum and Biofuels Energy Use in Transportation
(Billion Gallons)



Source: *Annual Energy Outlook 2009* Updated Reference Case d041409a

GHG Emissions in Transportation by Fuel Type 1950-2030

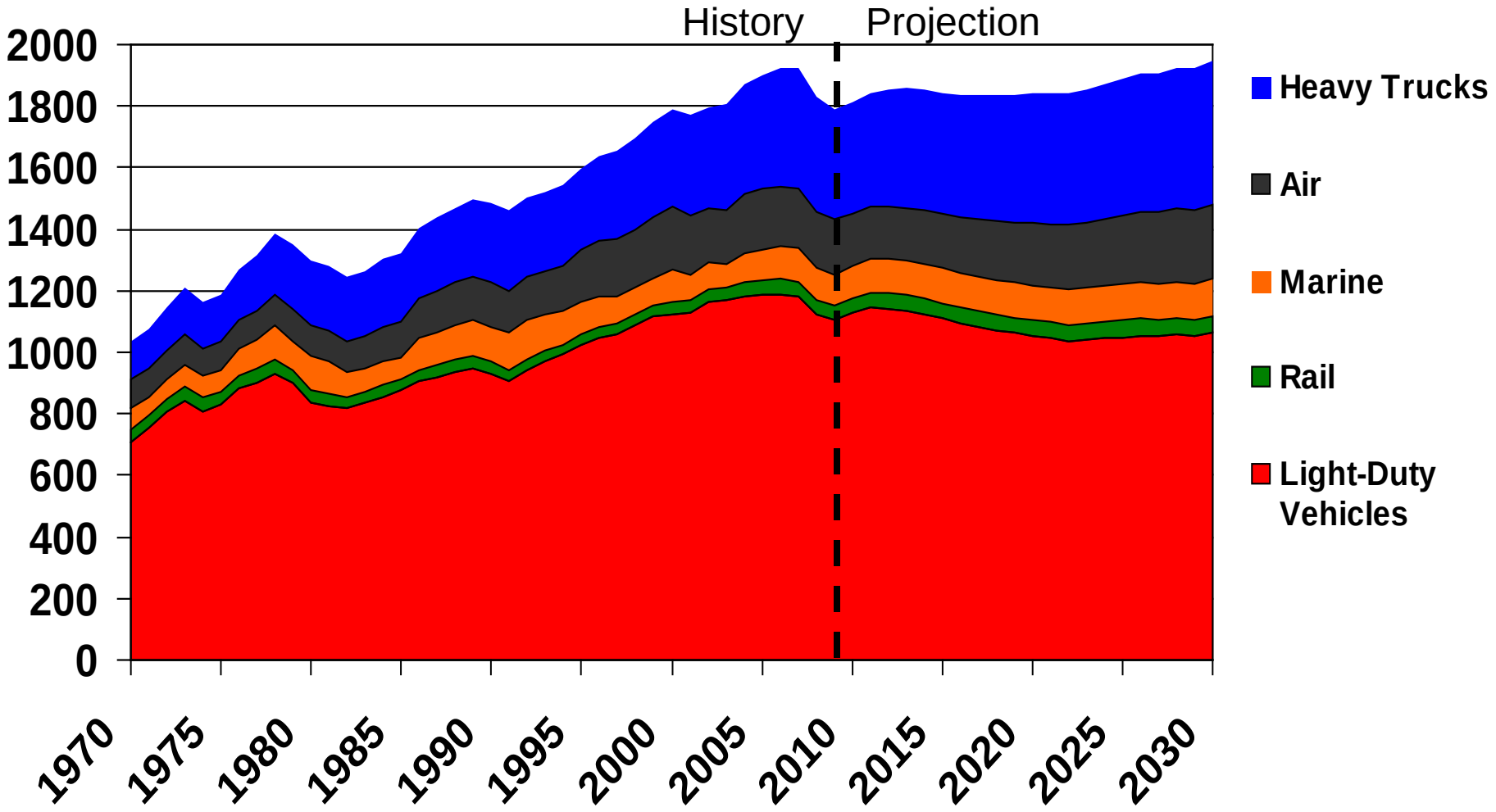
(Million Metric Tons CO_2 Equivalent)



Sources: History: *Annual Energy Review*, 1960-1980 *State Energy Data Report*; 1990-2000 *Emissions of Greenhouse Gases in the United States 2007*
Projection: *Annual Energy Outlook 2009* Updated Reference Case d041409a

GHG Emissions by Transportation Mode

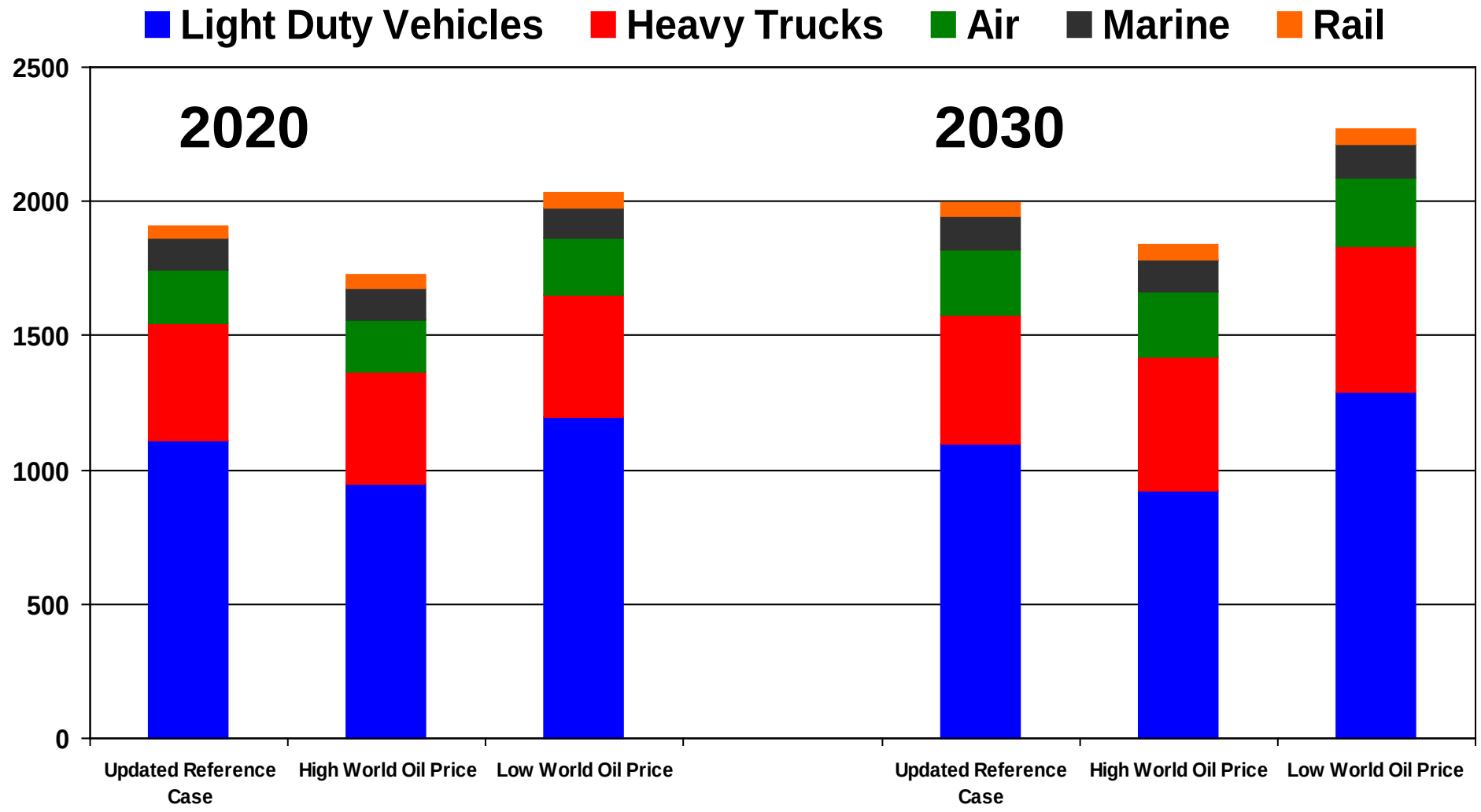
(Million Metric Tons CO2 Equivalent)



Source: History: *Transportation Energy Databook 28th Edition*
Projection: *Annual Energy Outlook 2009* Updated Reference Case d041409a

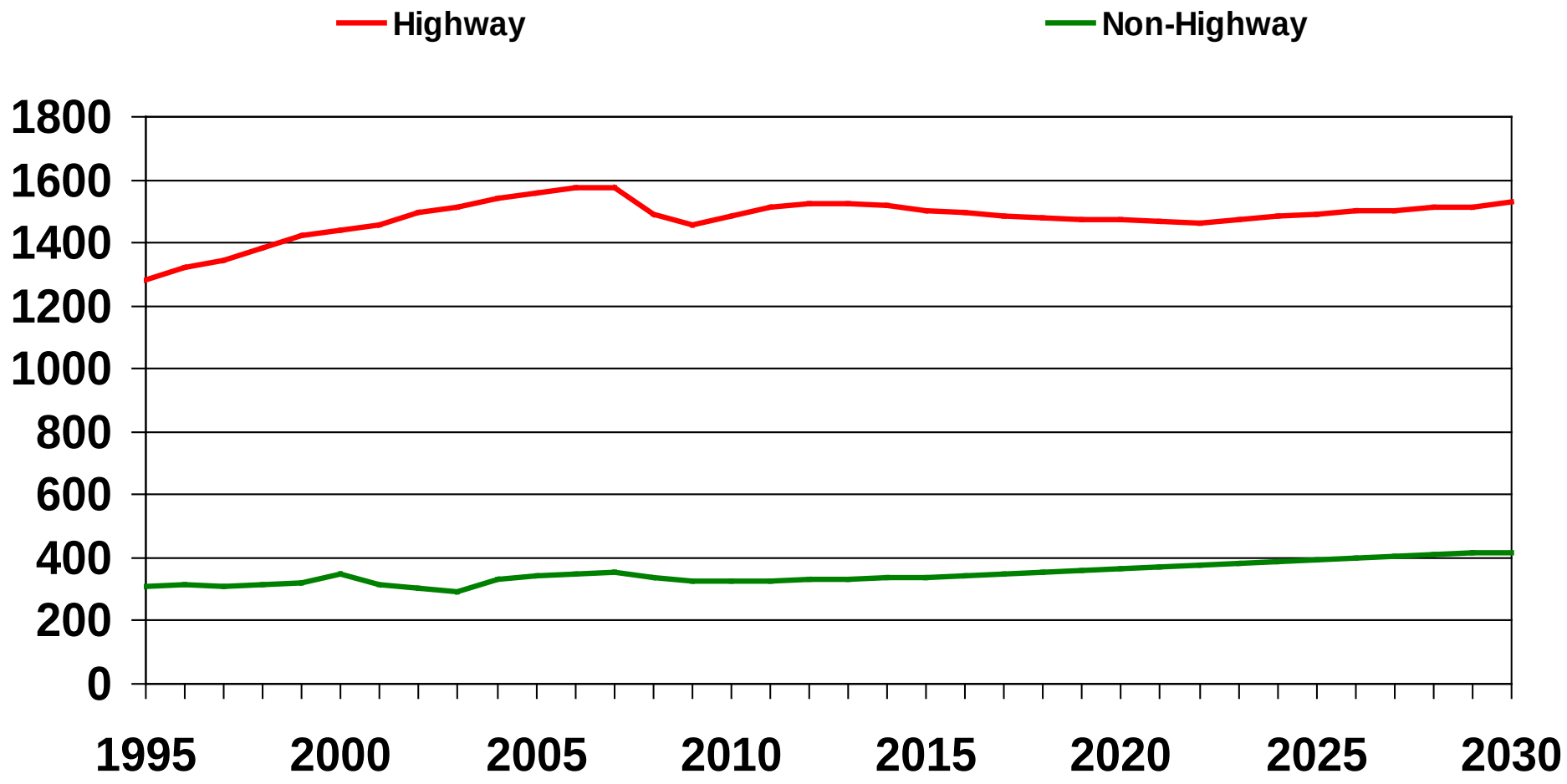
GHG Emissions Across Different Cases

(Million Metric Tons CO_2 Equivalent)



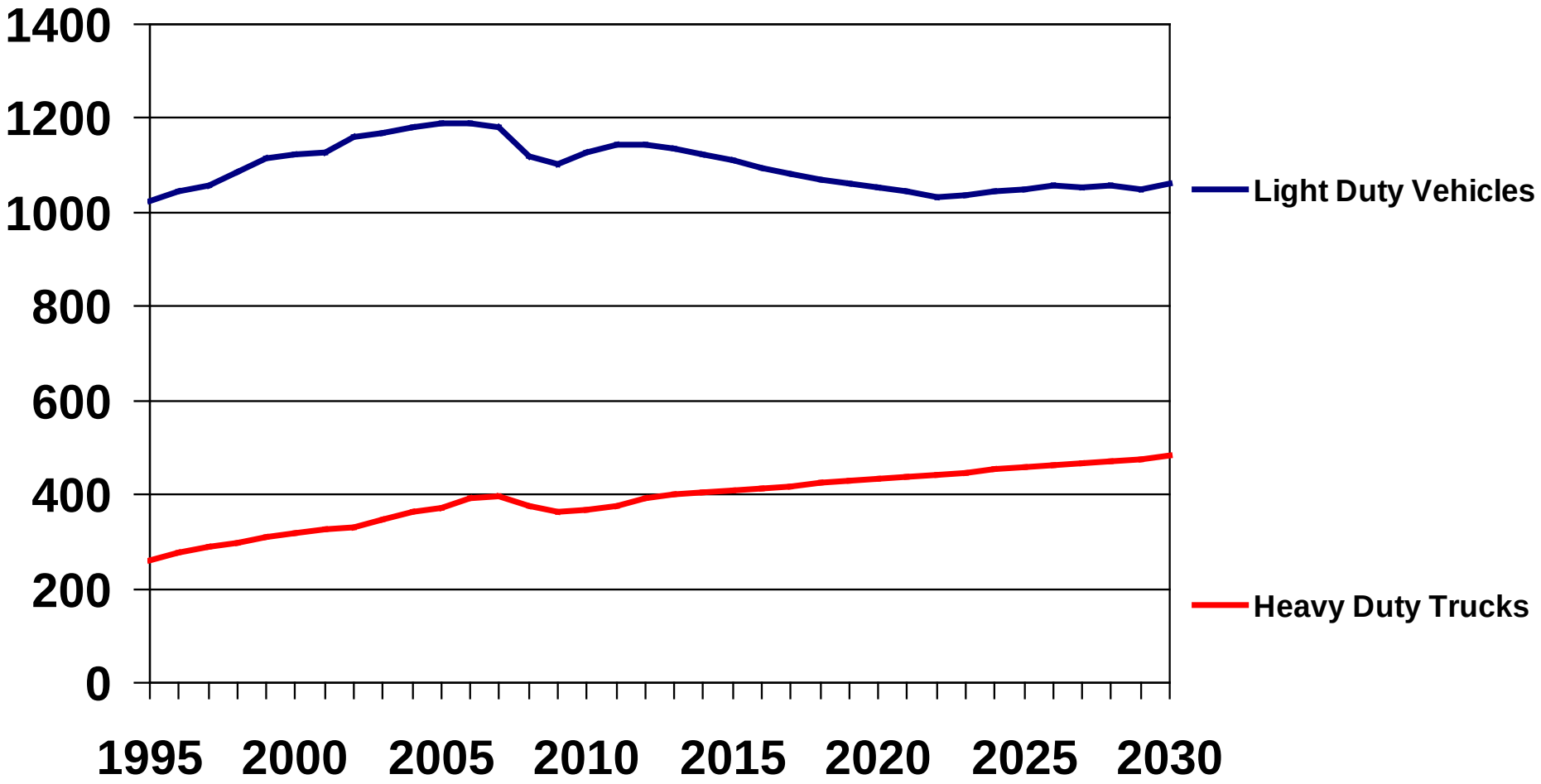
Sources: *Annual Energy Outlook 2009* Updated Reference Case d041409a
High Price Case d121108a; Low Price Case d122308a

Highway and Non-Highway GHG Emissions
(Million Metric Tons CO_2 Equivalent)



Source: *Annual Energy Outlook 2009* Updated Reference Case d041409a

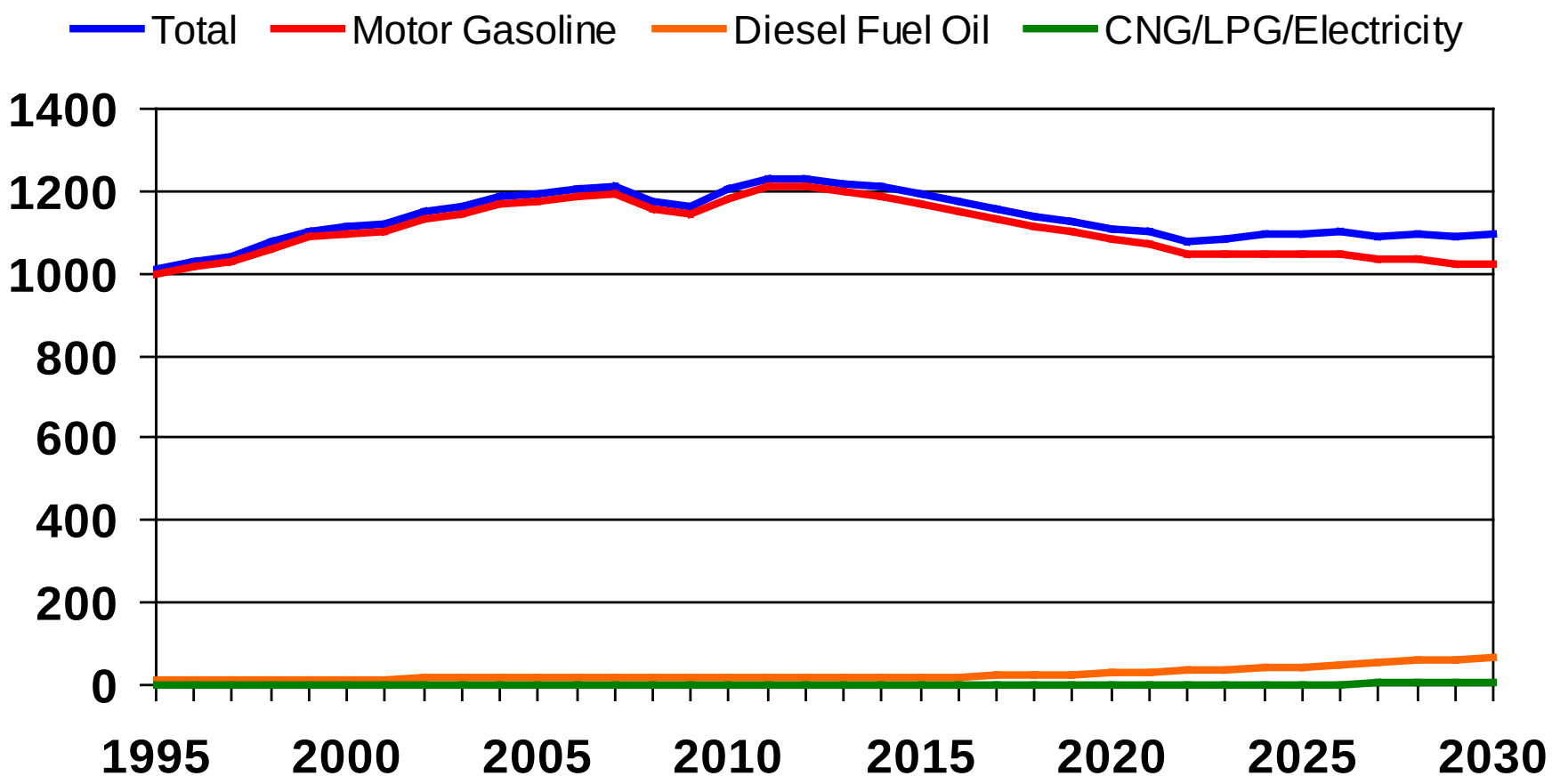
Highway GHG Emissions by Mode
(Million Metric Tons CO2 Equivalent)



Source: *Annual Energy Outlook 2009* Updated Reference Case d041409a

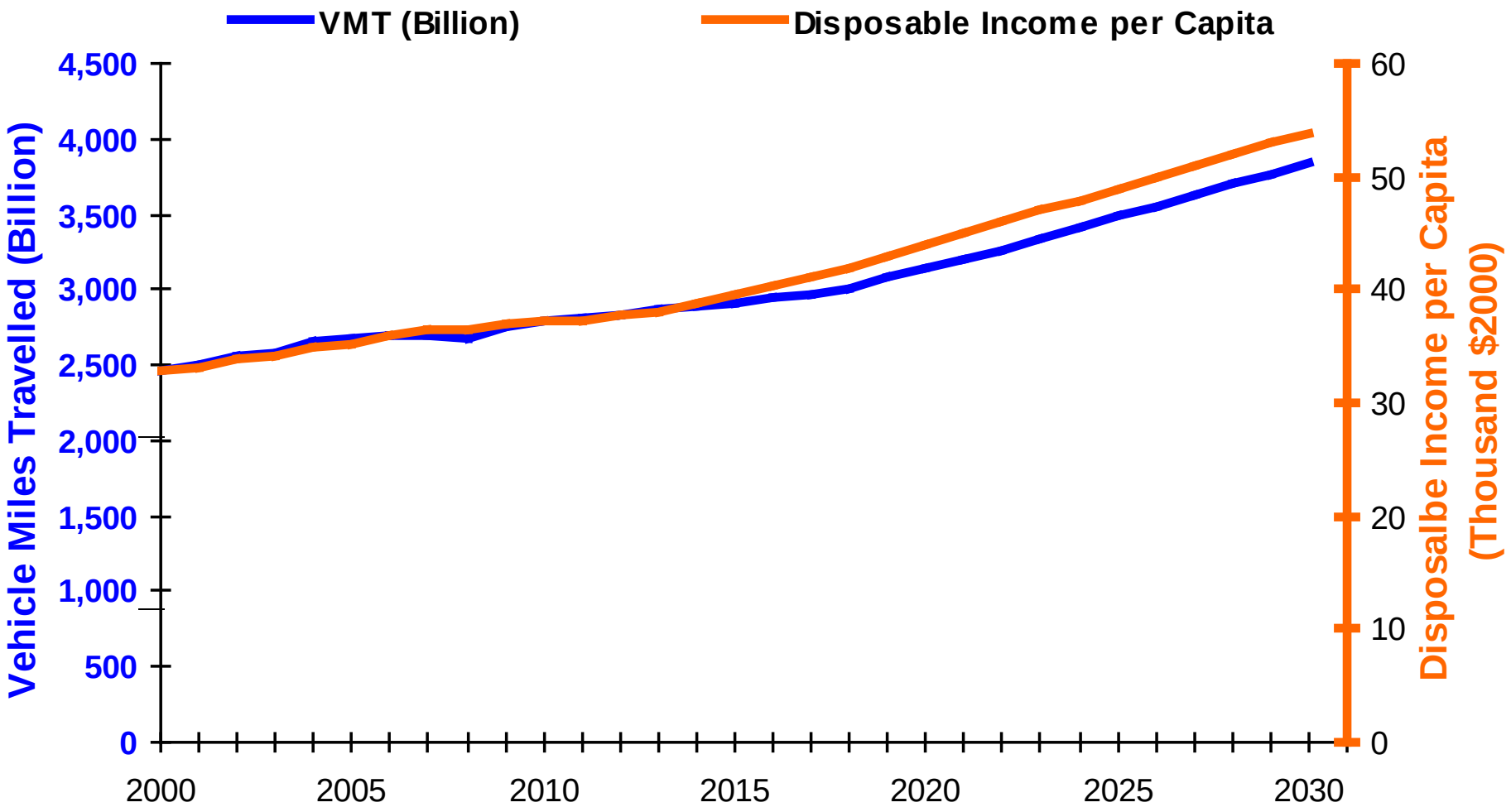
Light Duty Vehicle GHG Emissions by Fuel Type

(Million Metric Tons CO_2 Equivalent)



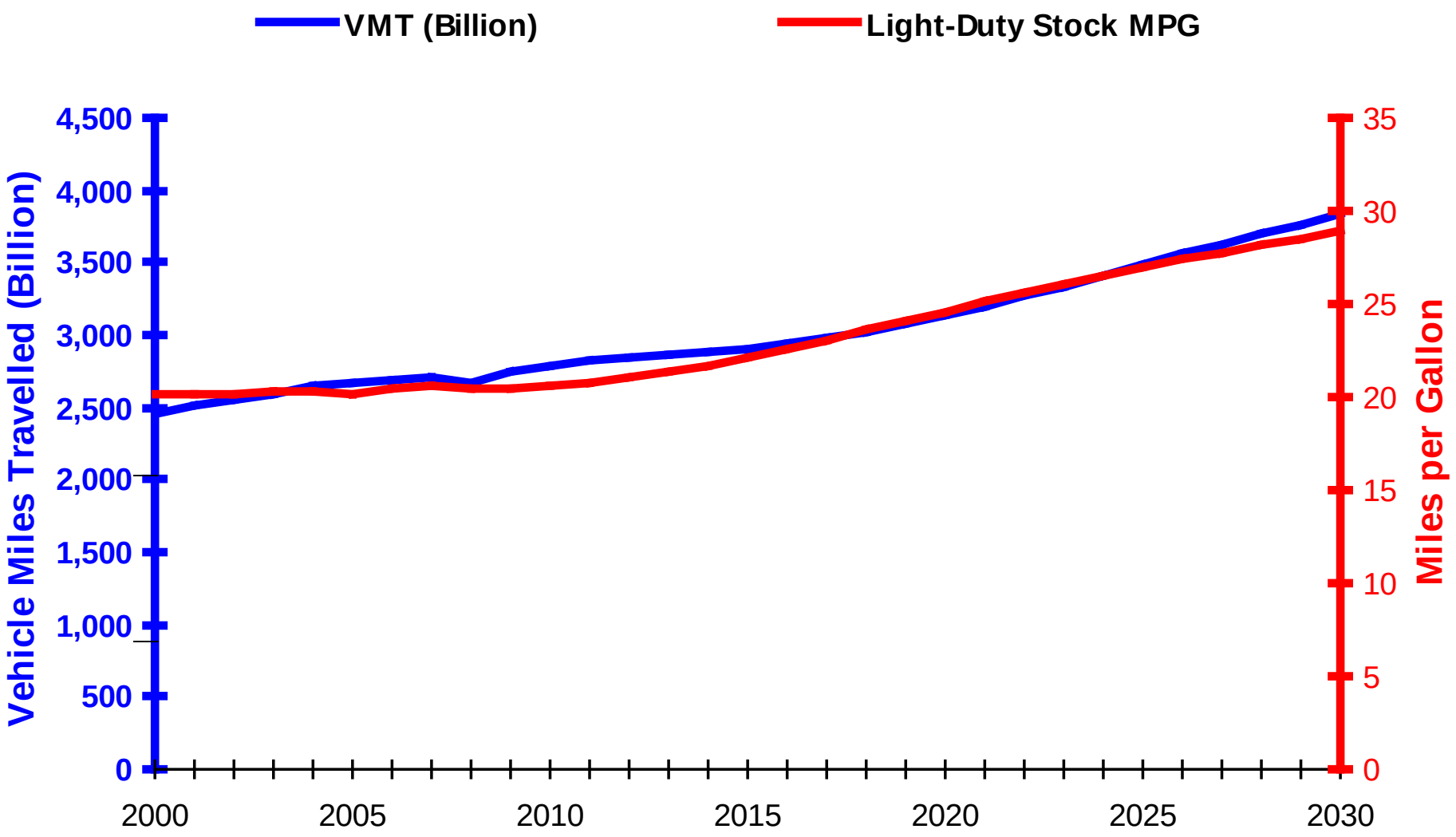
Source: *Annual Energy Outlook 2009* Updated Reference Case d041409a

Light Duty Vehicle Miles Travelled (1 of 3)



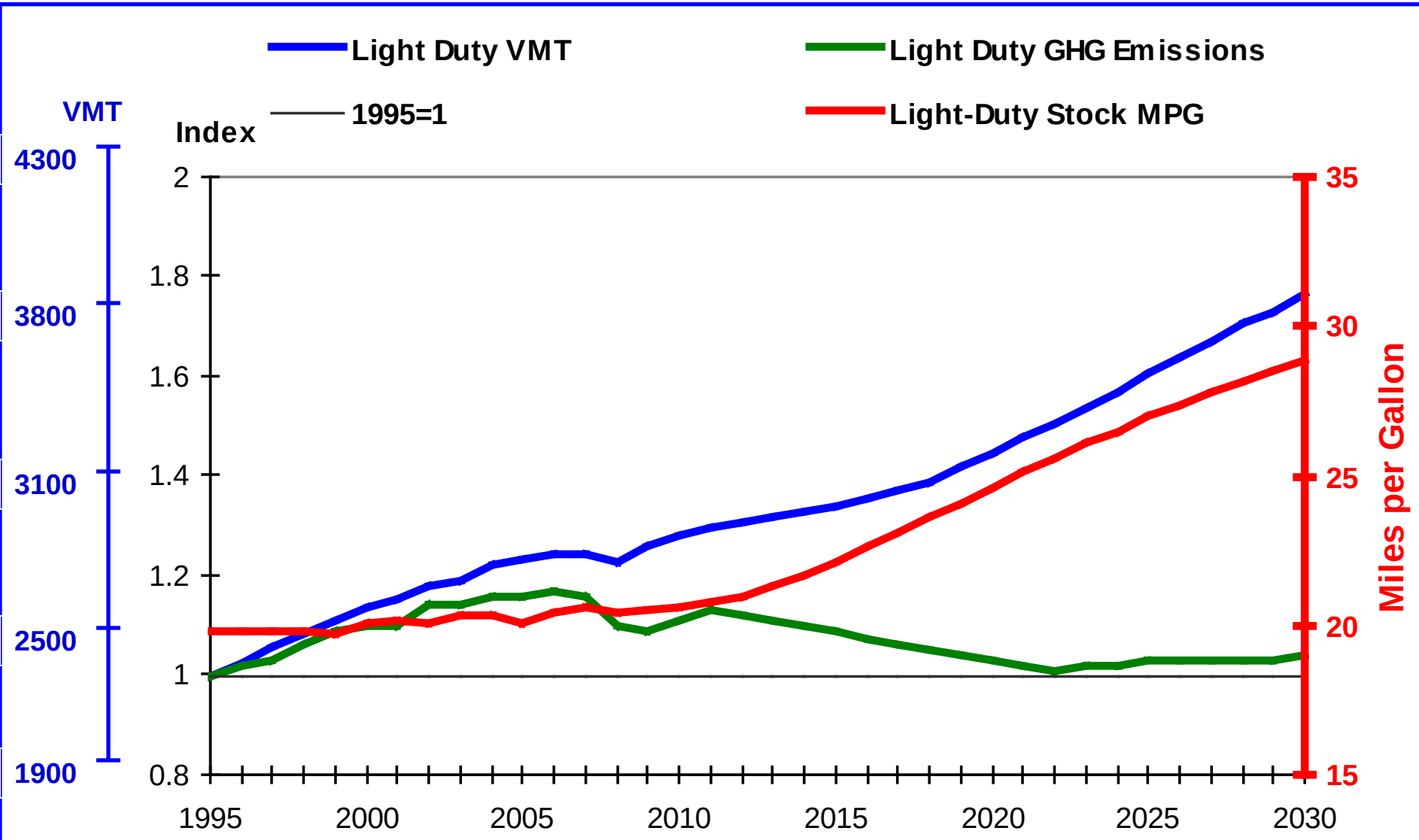
Source: *Annual Energy Outlook 2009* Reference Case d041409a

Light Duty Vehicle Miles Travelled (2 of 3)



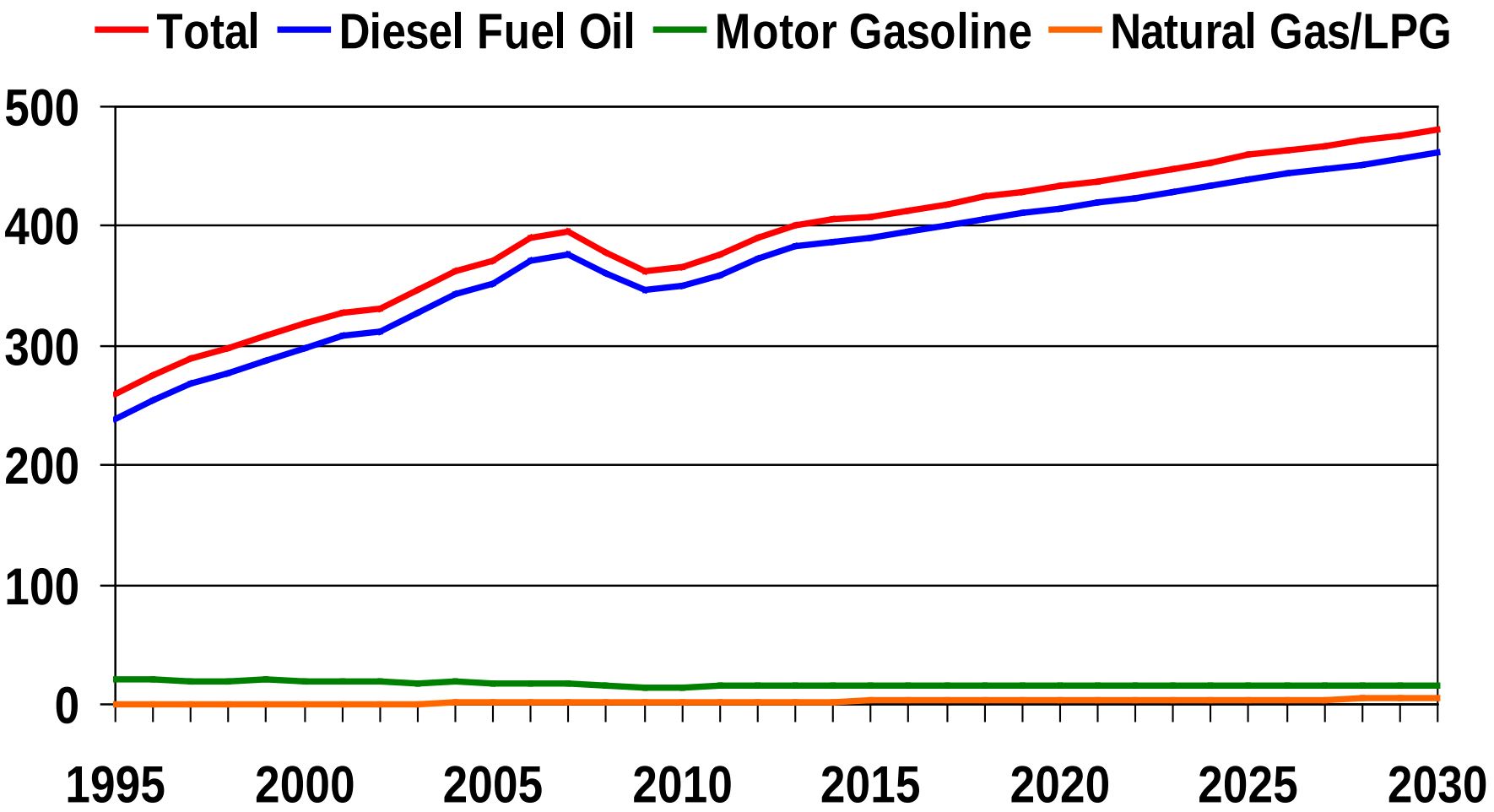
Source: *Annual Energy Outlook 2009* Reference Case d041409a

Light Duty VMT, MPG, and GHG Emissions (3 of 3)



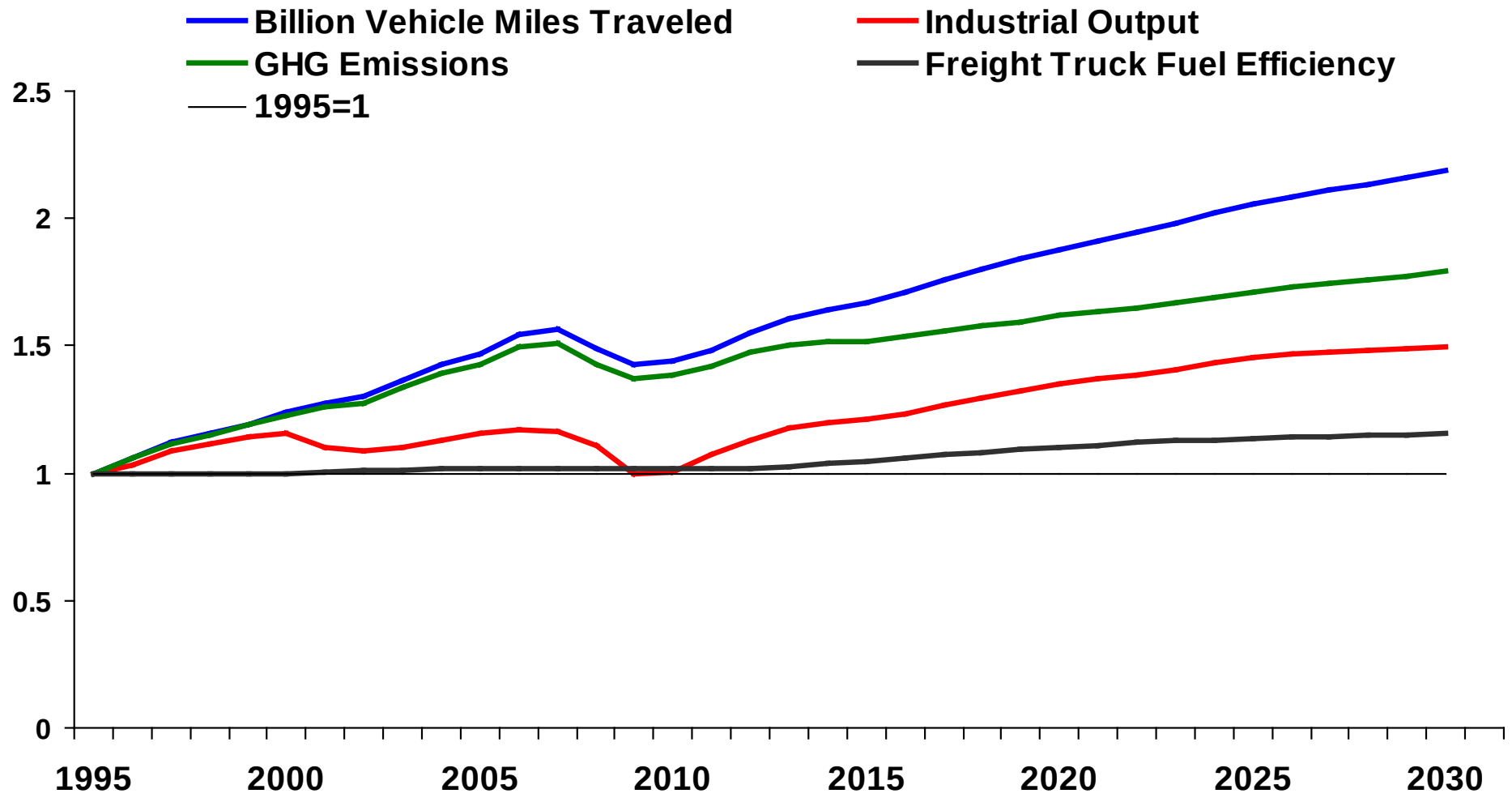
Source: *Annual Energy Outlook 2009* Updated Reference Case d041409a

Heavy Truck GHG Emissions by Fuel Type
(Million Metric Tons CO_2 Equivalent)



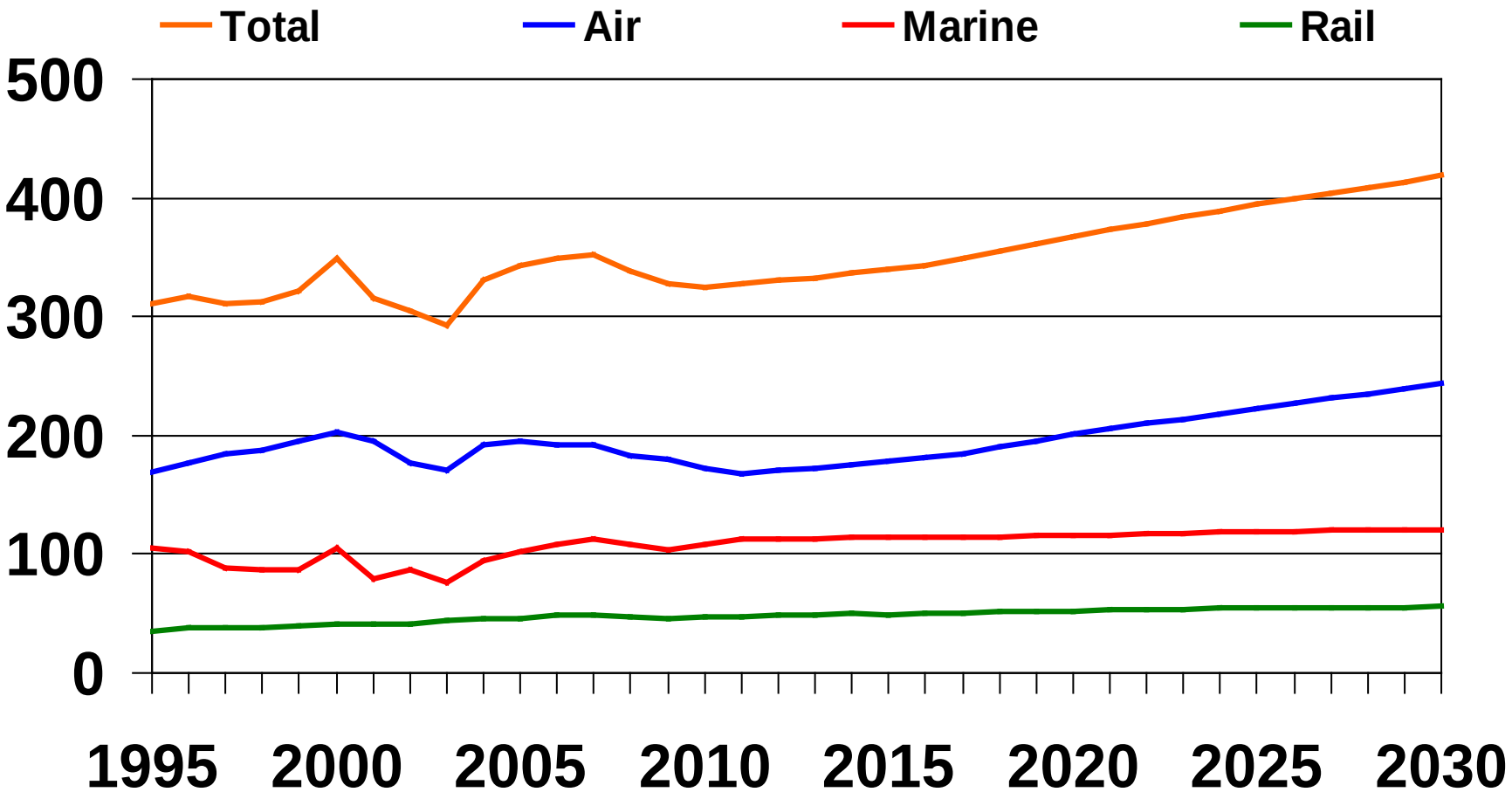
Source: *Annual Energy Outlook 2009* Updated Reference Case d041409a

Heavy Truck Vehicle Miles Travelled, Industrial Value of Shipments, and Fuel Efficiency



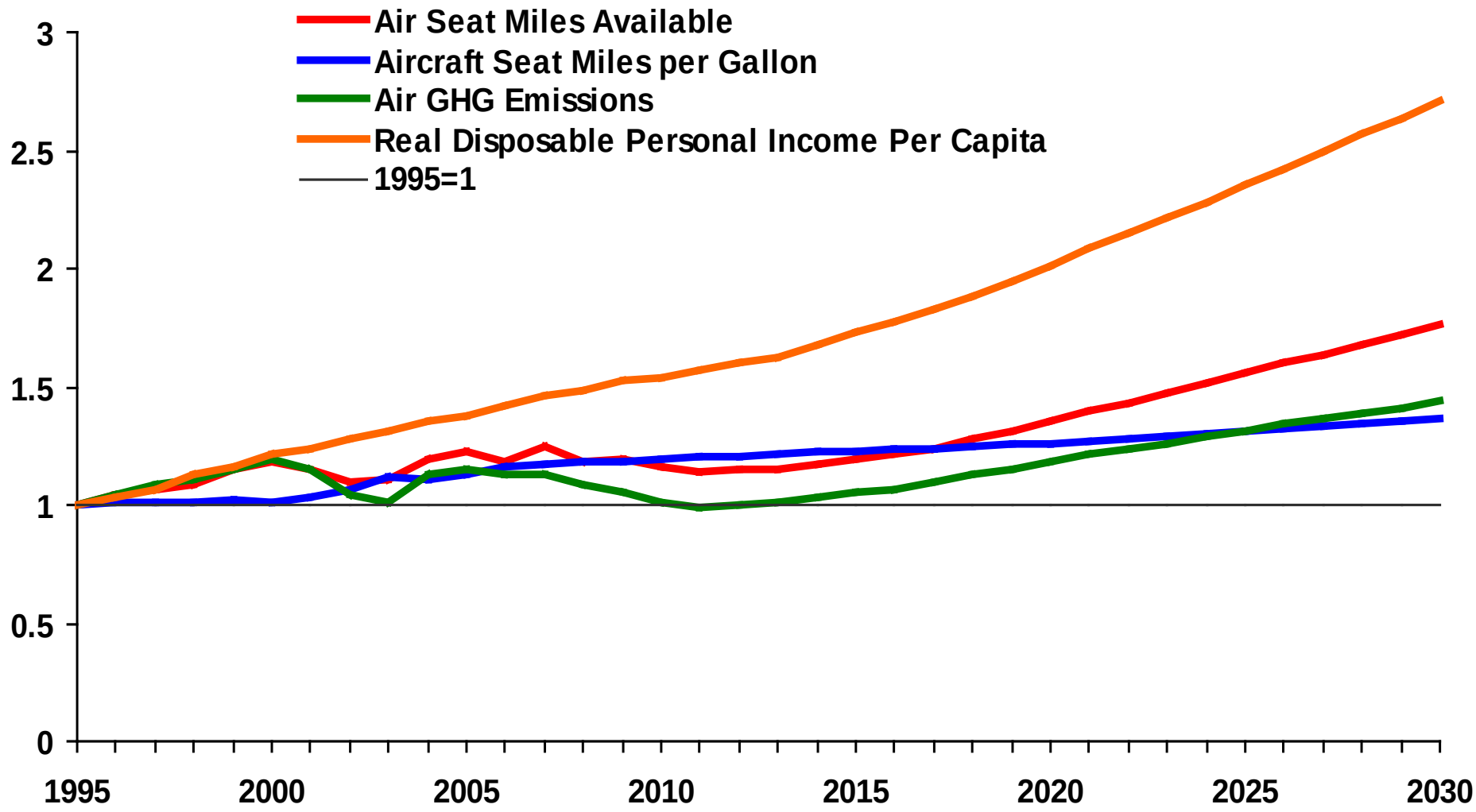
Source: *Annual Energy Outlook 2009* Updated Reference Case d041409a

Non-Highway GHG Emissions by Mode
(Million Metric Tons CO_2 Equivalent)



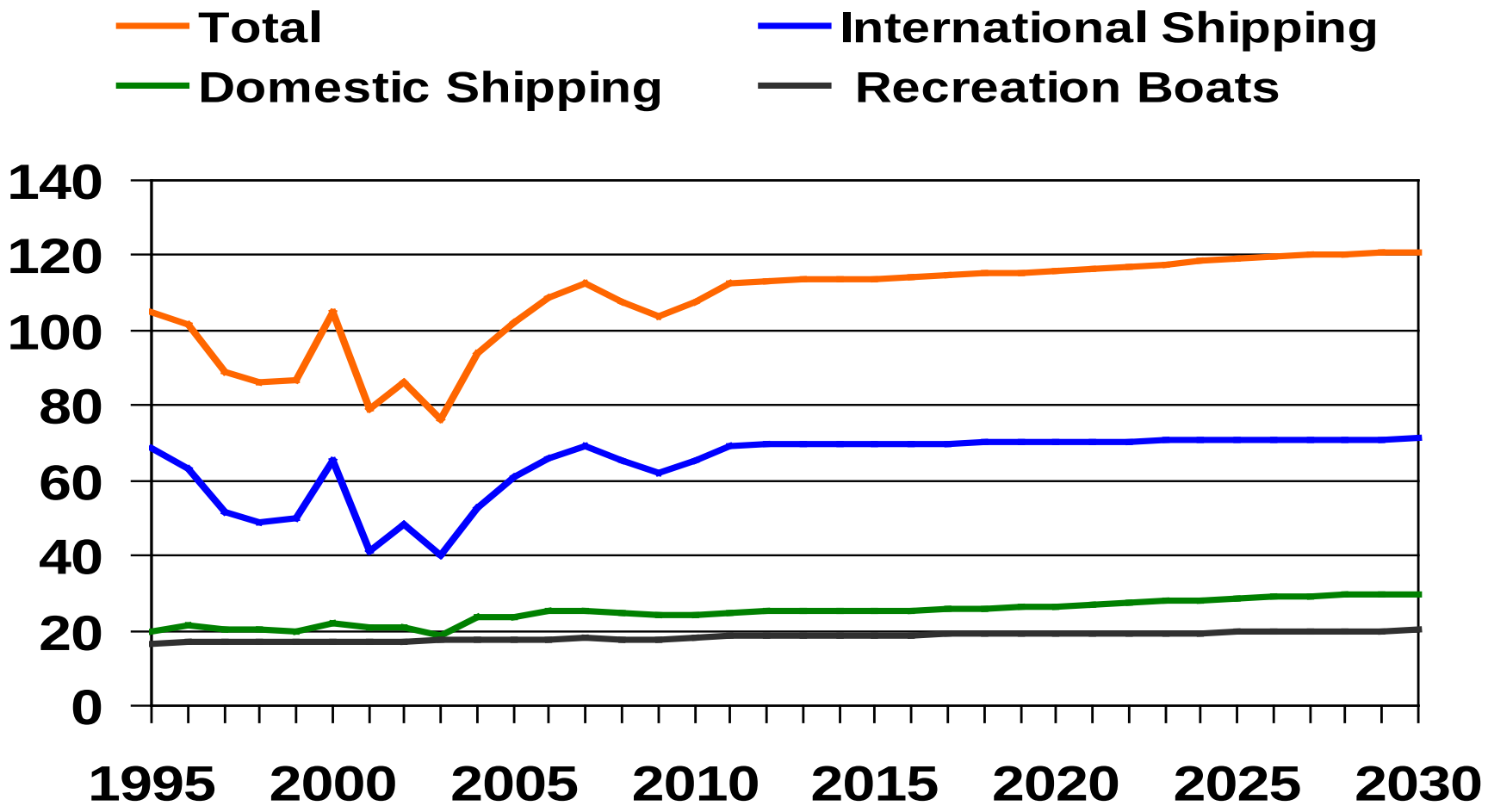
Source: *Annual Energy Outlook 2009* Updated Reference Case d041409a

Air Travel Demand, Energy Efficiency, GHG Emissions, and Income



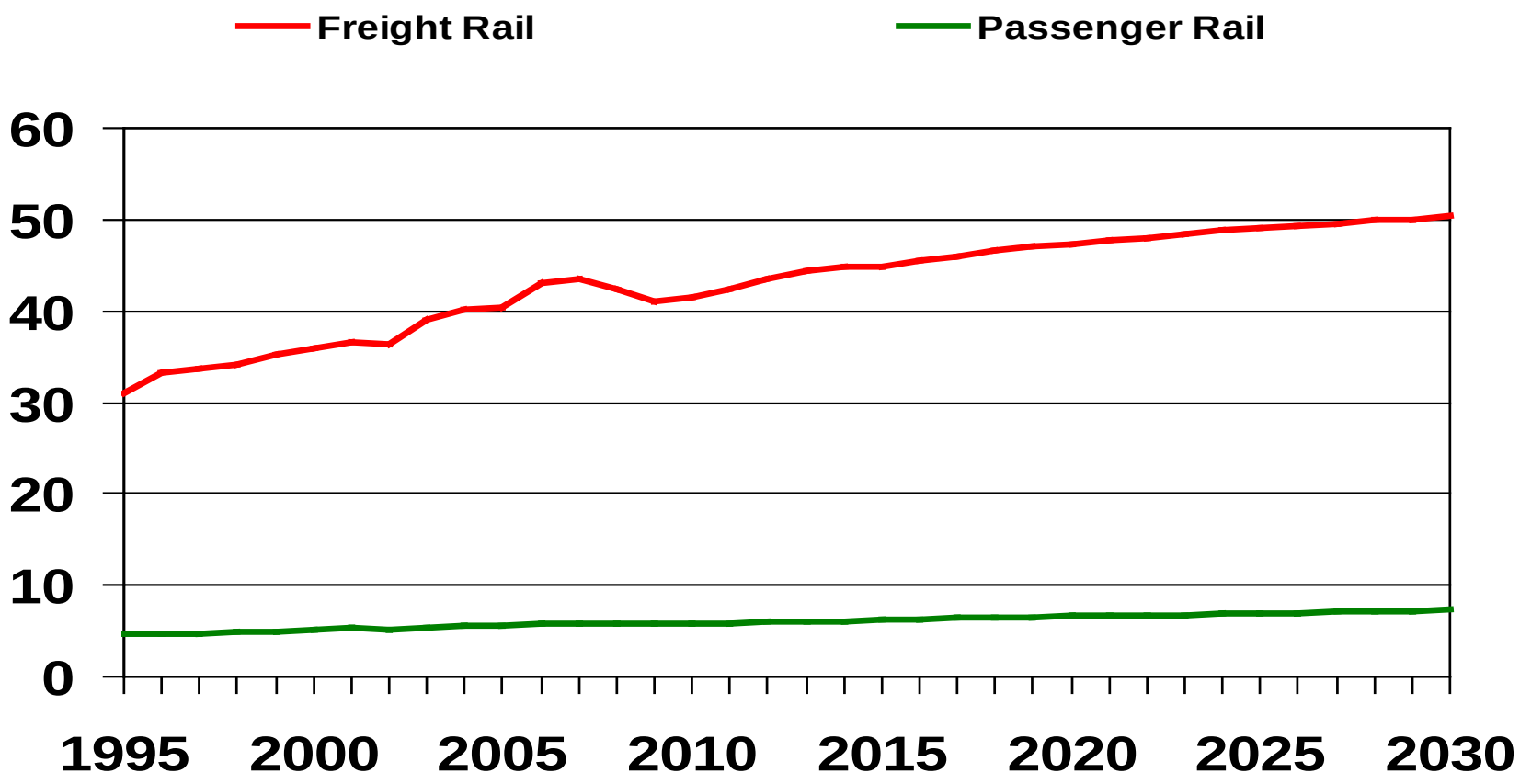
Source: *Annual Energy Outlook 2009* Updated Reference Case d041409a

U.S. Marine GHG Emissions by Mode
(Million Metric Tons CO_2 Equivalent)



Source: *Annual Energy Outlook 2009* Updated Reference Case d041409a

Rail GHG Emissions by Mode
(Million Metric Tons CO_2 Equivalent)



Source: *Annual Energy Outlook 2009* Updated Reference Case d041409a

Conclusions

- The transportation sector is projected to be the largest GHG emitter by end use sector by 2030.
  - –80% of transportation emissions come from highway vehicles
- Reductions in transportation GHG emissions will be challenging
  - –Efforts to reduce GHG emissions in non-highway modes will be especially difficult because non-highway modes are already relatively fuel efficient
- If travel is projected to be as closely tied to economic activity as it has been historically, there will be increased demand for transportation end-use services,
- Given the link to economic activity, reduction in transportation sector GHG emissions will require:
  - –a shift to more efficient modes of transportation,
  - –improvements in the efficiency of transportation technologies, or
  - –a reduction in the carbon content of the fuel used.

Questions?

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