

U.S. Greenhouse Gas Emissions in the Transportation Sector

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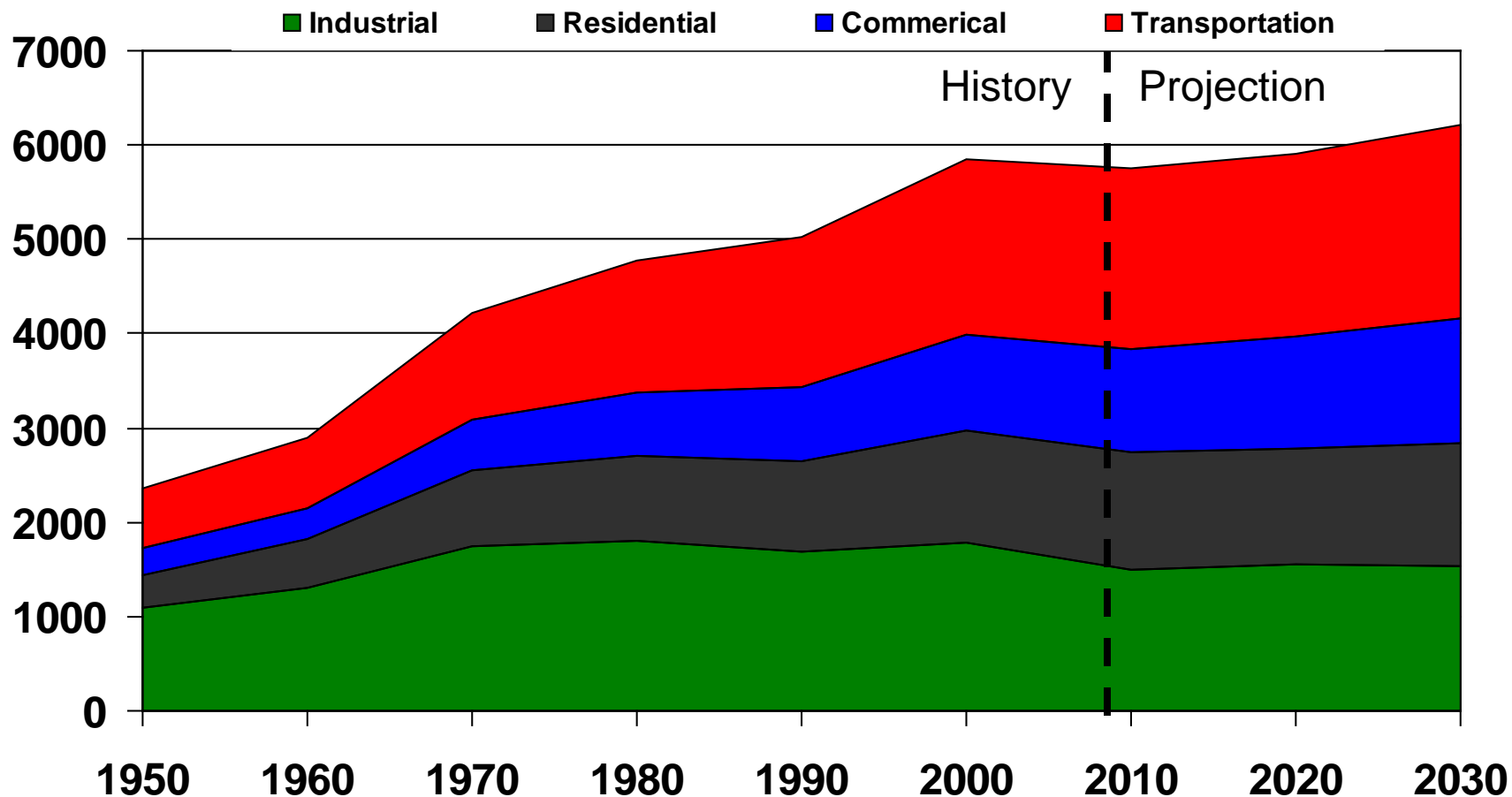


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Methodology

- 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 based 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)



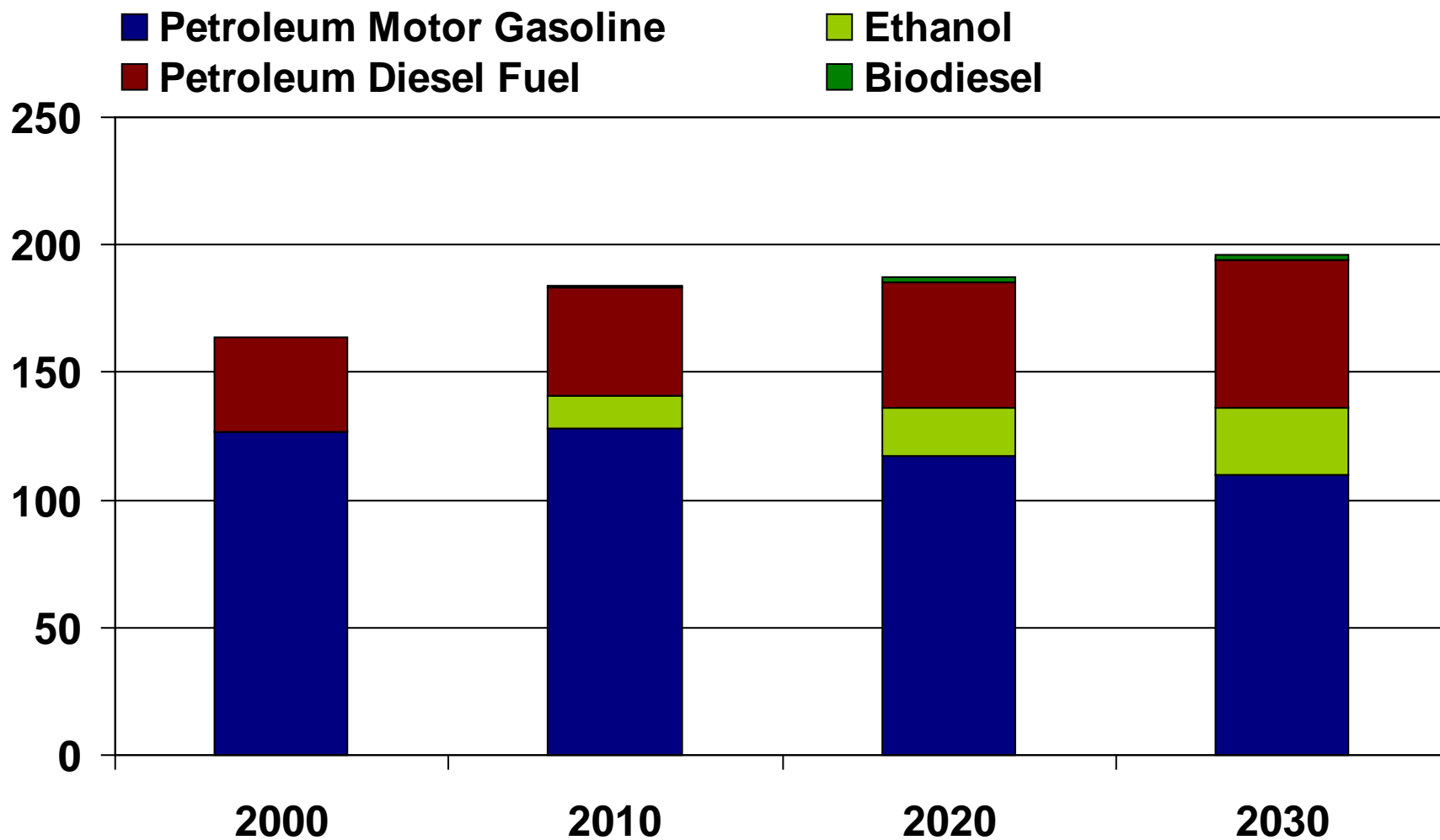
Sources: History: *Annual Energy Review*, 1960-1980 *State Energy Data Report*, 1990-2000 *Emissions of Greenhouse Gases in the United States 2007*
 Projection: *Annual Energy Outlook 2009 Updated Reference Case d041409a*



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.

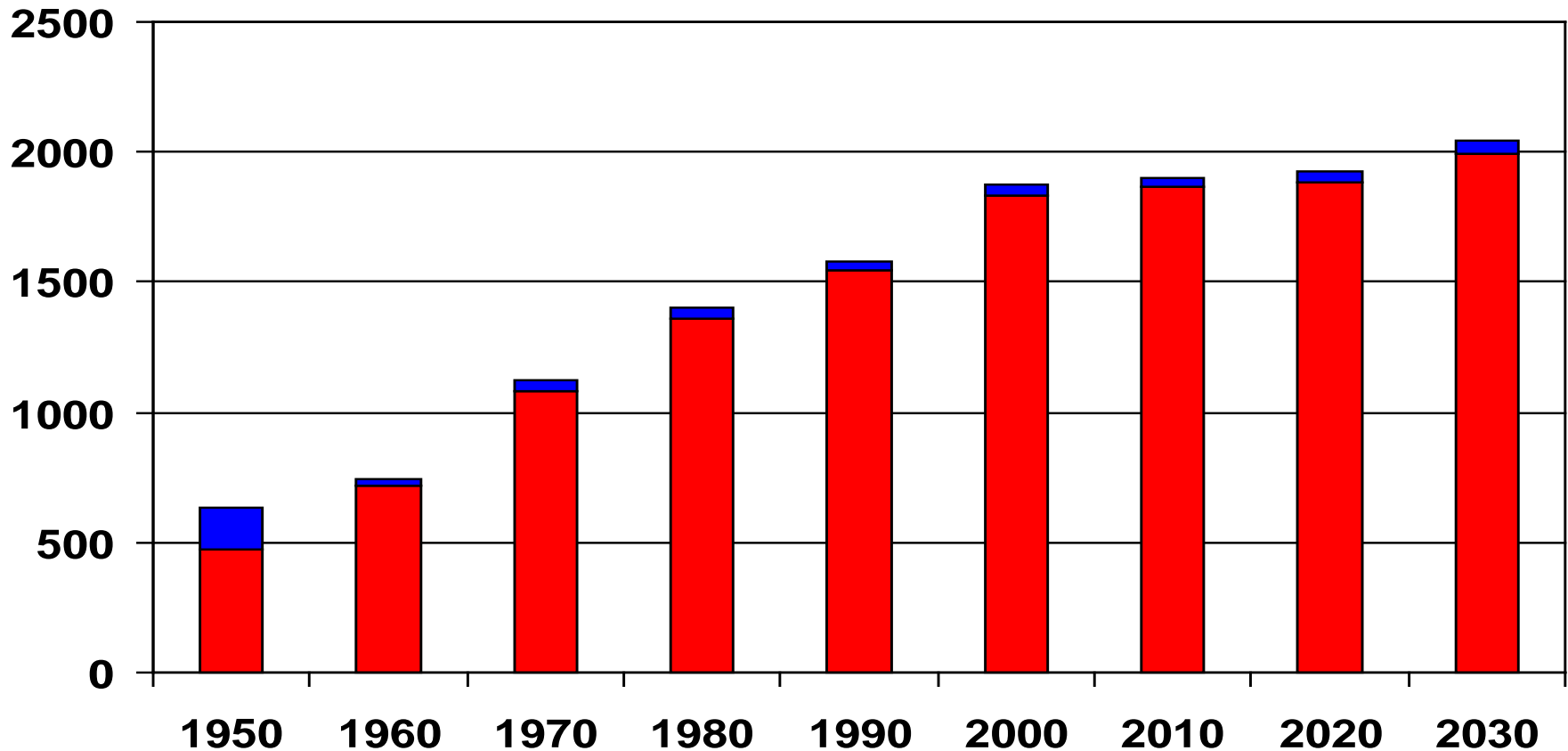
Petroleum and Biofuels Energy Use in Transportation (Billion Gallons)



GHG Emissions in Transportation by Fuel Type 1950-2030

(Million Metric Tons CO₂ Equivalent)

■ Petroleum ■ Other (Natural Gas, Electricity, Coal)

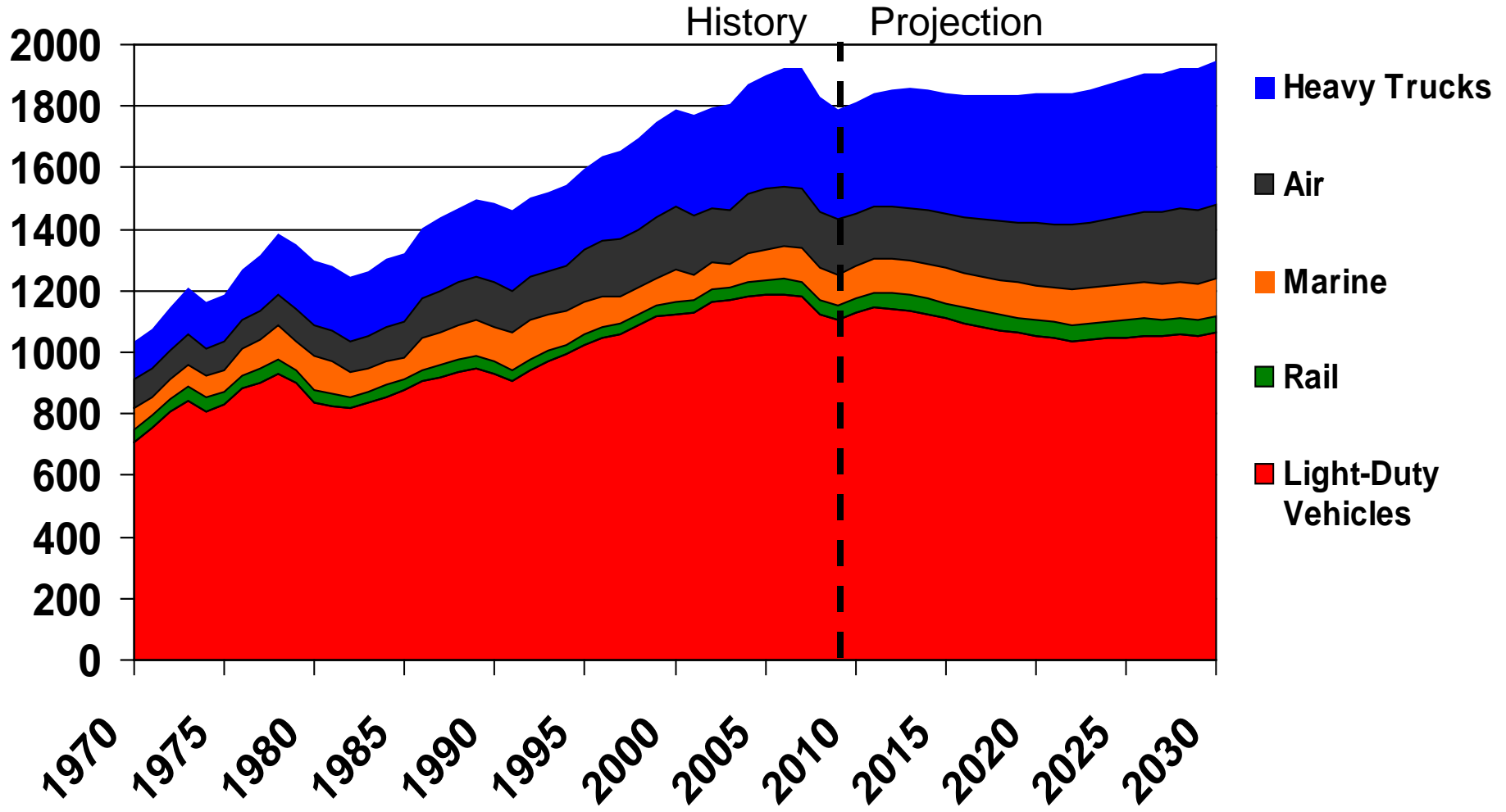


Sources: History: *Annual Energy Review*, 1960-1980 *State Energy Data Report*, 1990-2000 *Emissions of Greenhouse Gases in the United States 2007*
Projection: *Annual Energy Outlook 2009 Updated Reference Case d041409a*



GHG Emissions by Transportation Mode

(Million Metric Tons CO2 Equivalent)

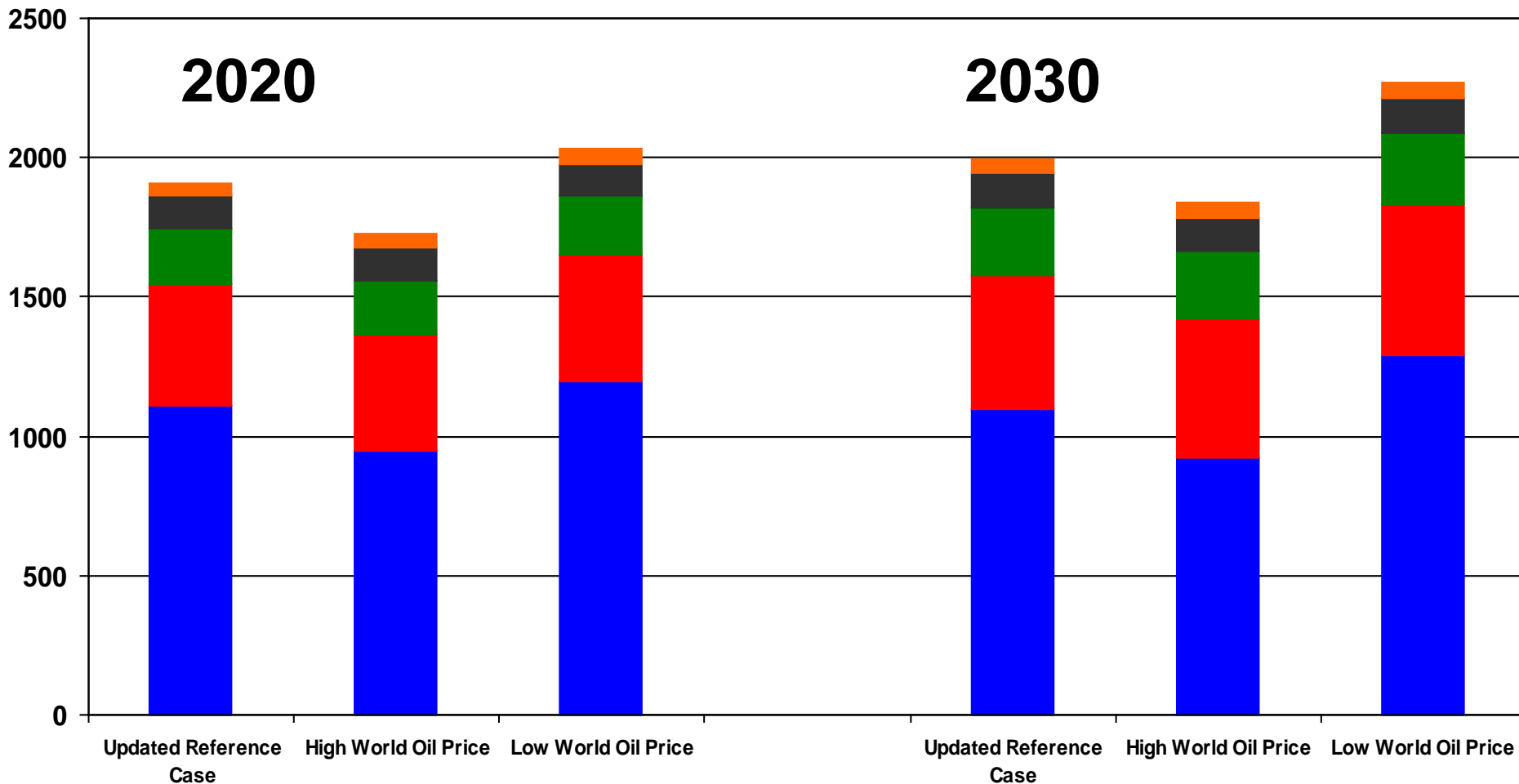


Source: History: *Transportation Energy Databook 28th Edition*
 Projection: *Annual Energy Outlook 2009 Updated Reference Case d041409a*

GHG Emissions Across Different Cases

(Million Metric Tons CO₂ Equivalent)

■ Light Duty Vehicles
 ■ Heavy Trucks
 ■ Air
 ■ Marine
 ■ Rail

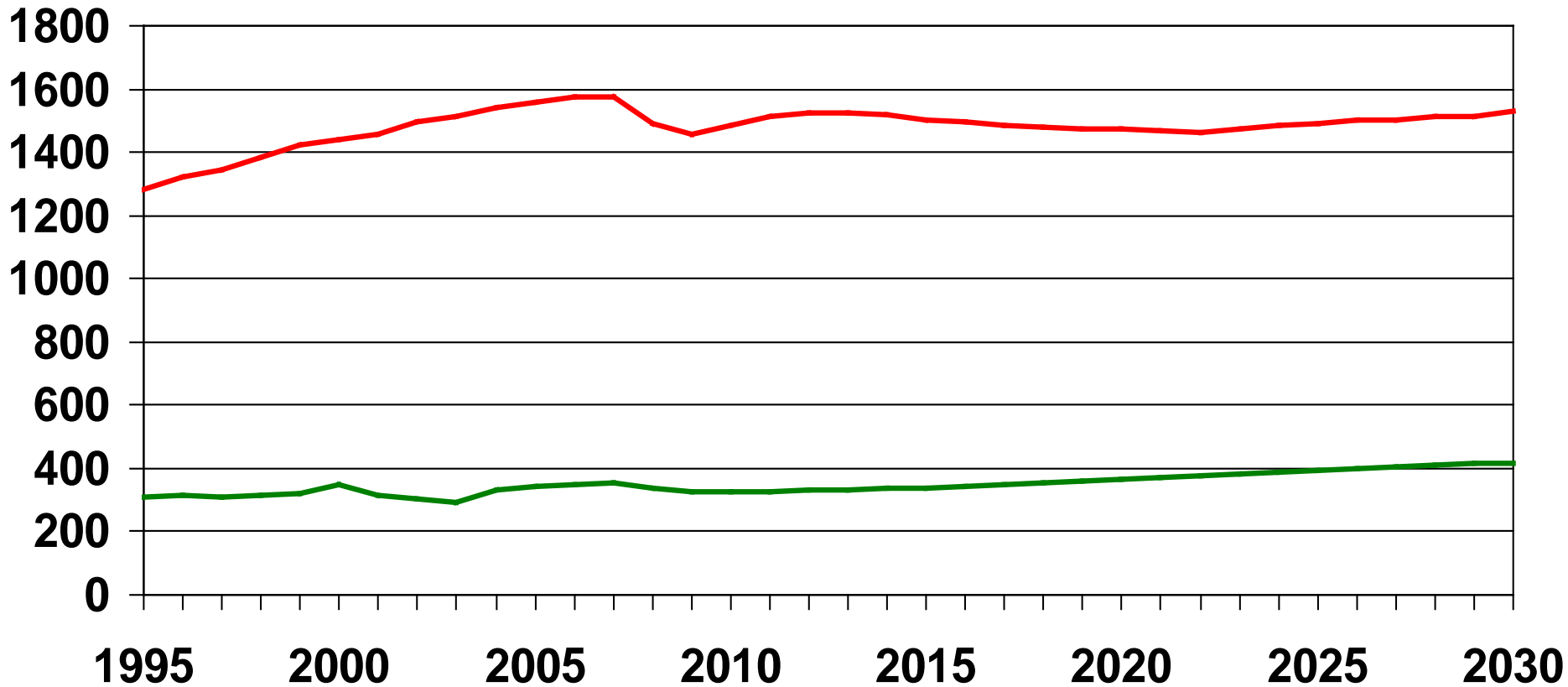


Sources: *Annual Energy Outlook 2009* Updated Reference Case d041409a
 High Price Case d121108a; Low Price Case d122308a

Highway and Non-Highway GHG Emissions (Million Metric Tons CO₂ Equivalent)

Highway

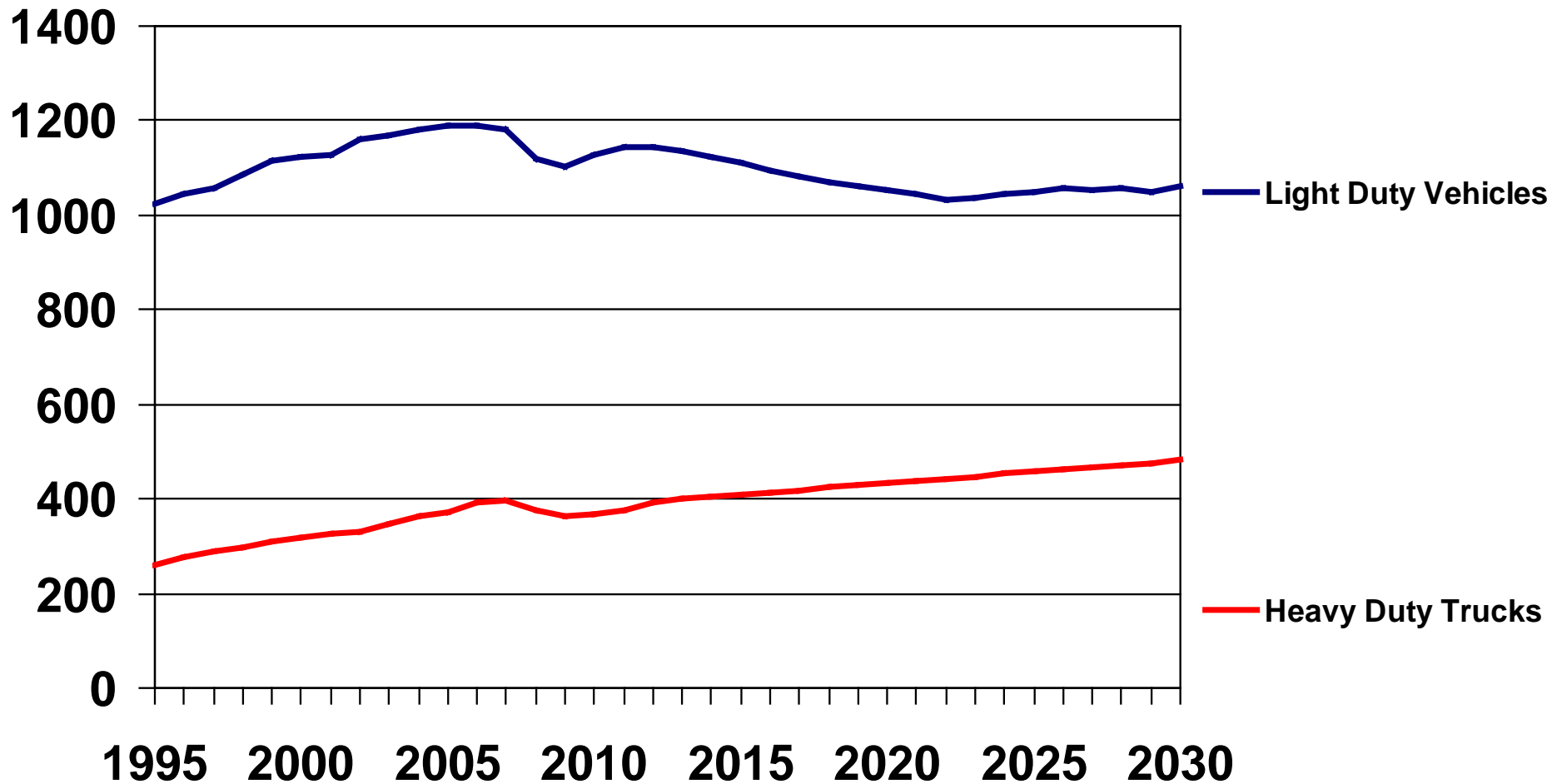
Non-Highway



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

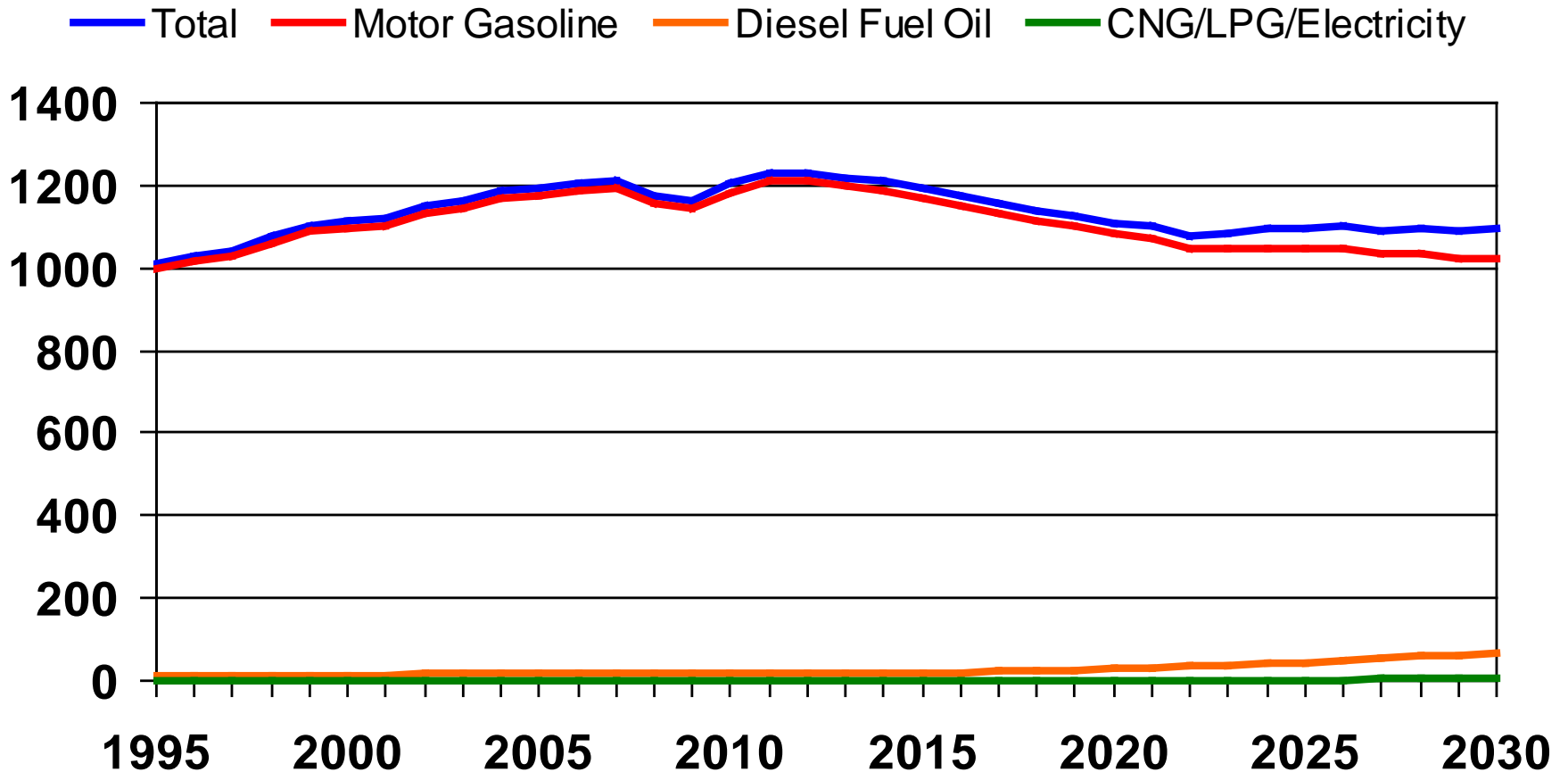
Highway GHG Emissions by Mode

(Million Metric Tons CO2 Equivalent)

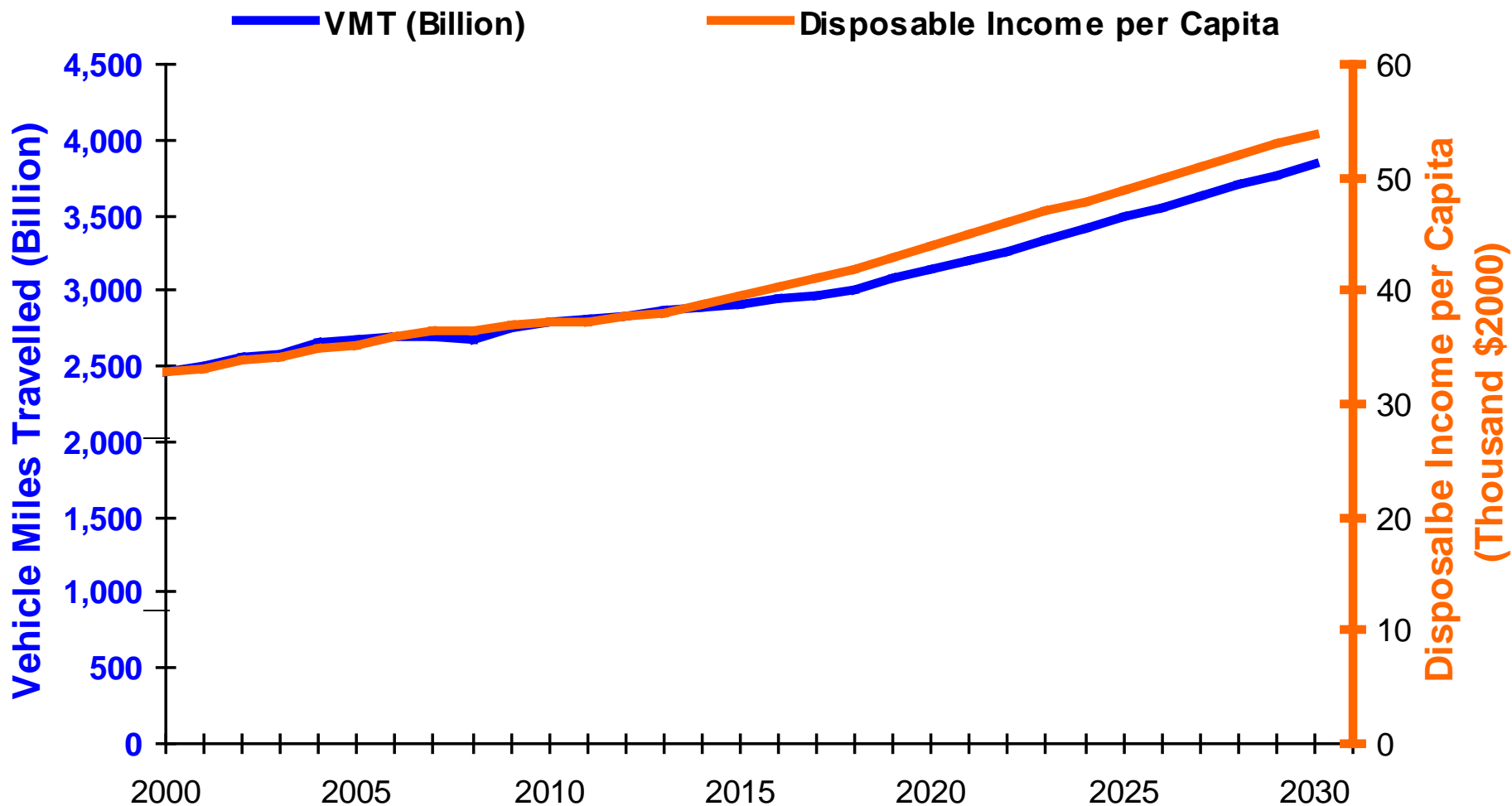


Light Duty Vehicle GHG Emissions by Fuel Type

(Million Metric Tons CO₂ Equivalent)

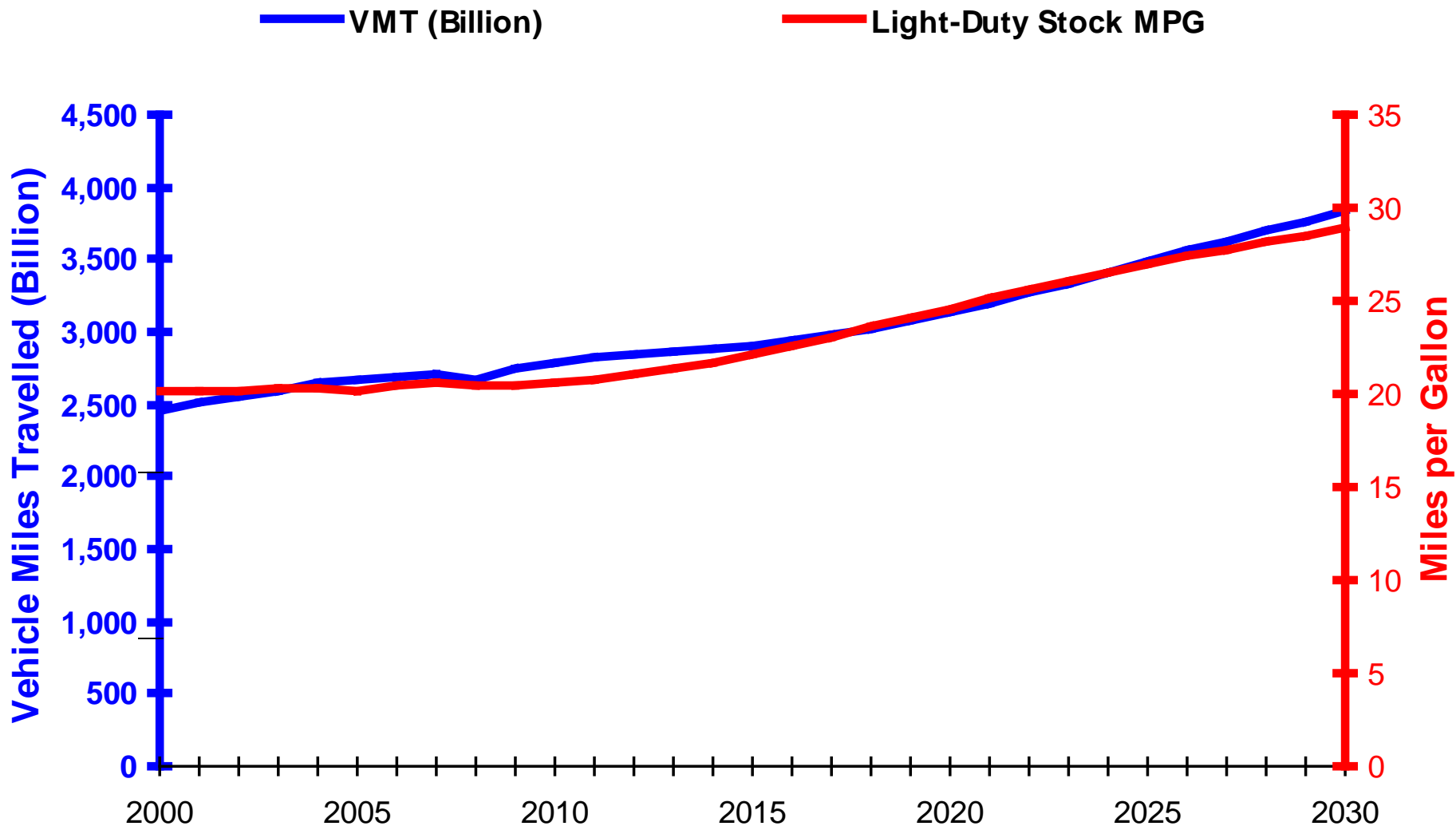


Light Duty Vehicle Miles Travelled (1 of 3)



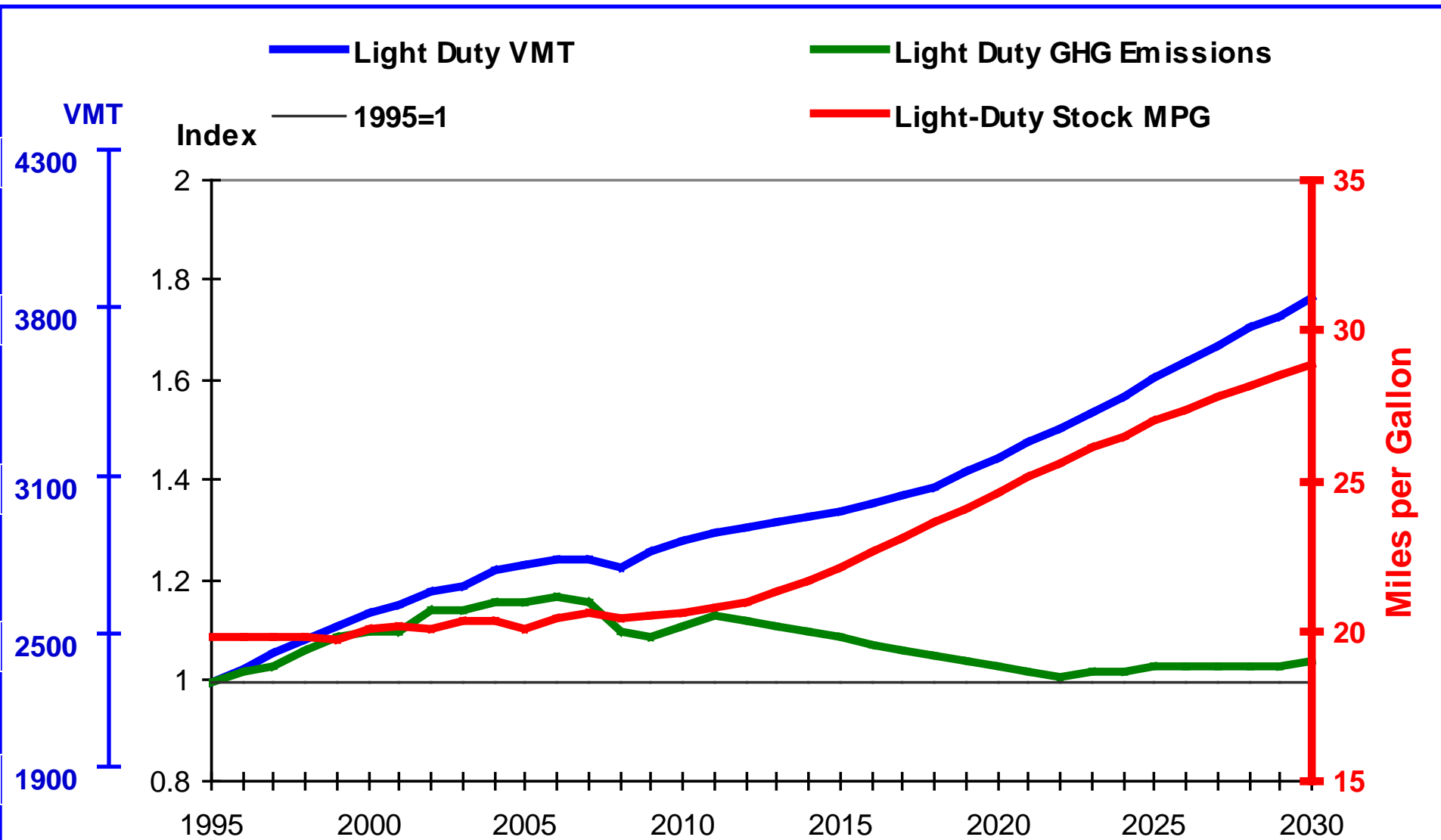
Source: *Annual Energy Outlook 2009* Reference Case d041409a

Light Duty Vehicle Miles Travelled (2 of 3)



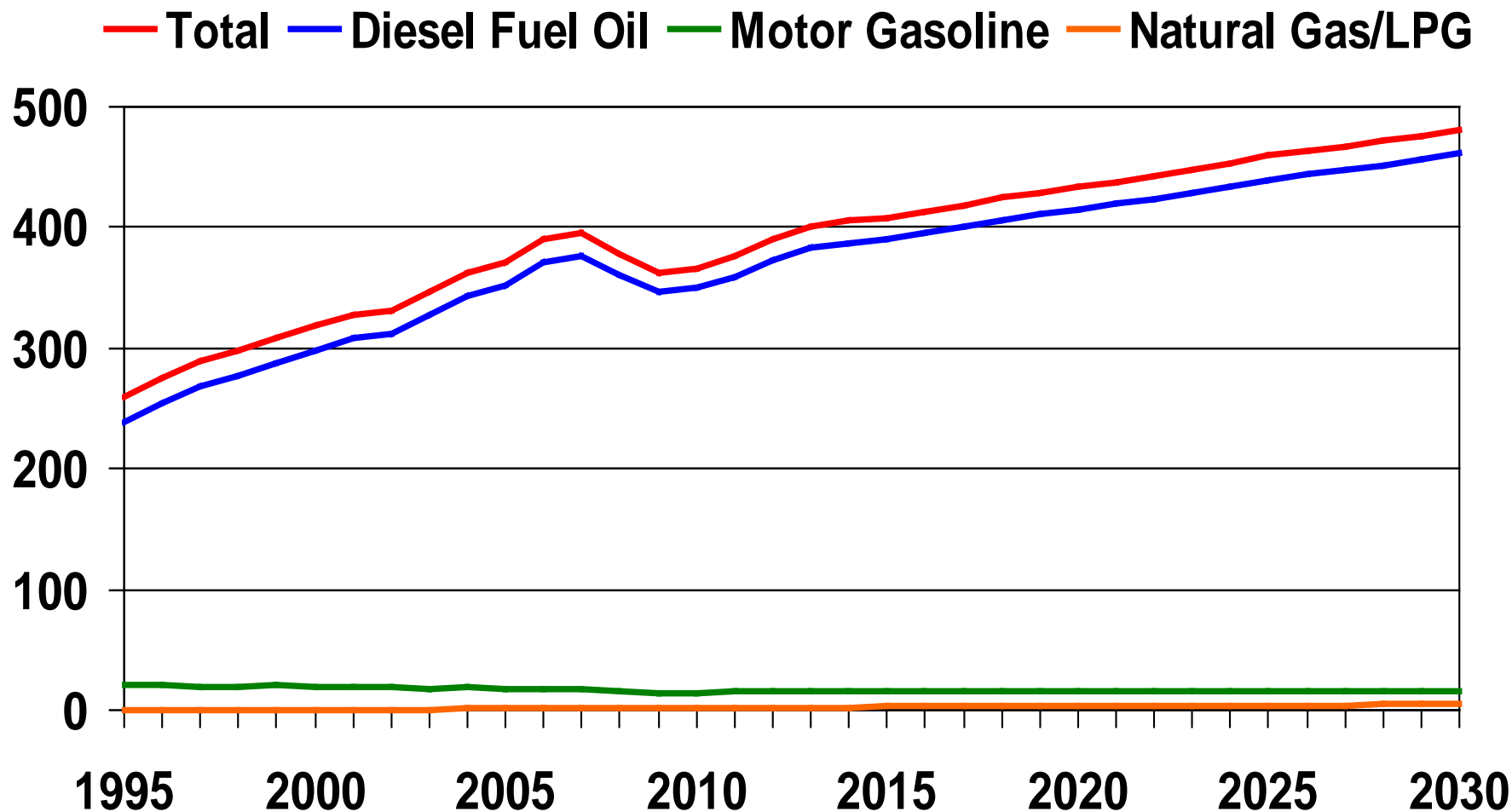
Source: *Annual Energy Outlook 2009* Reference Case d041409a

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



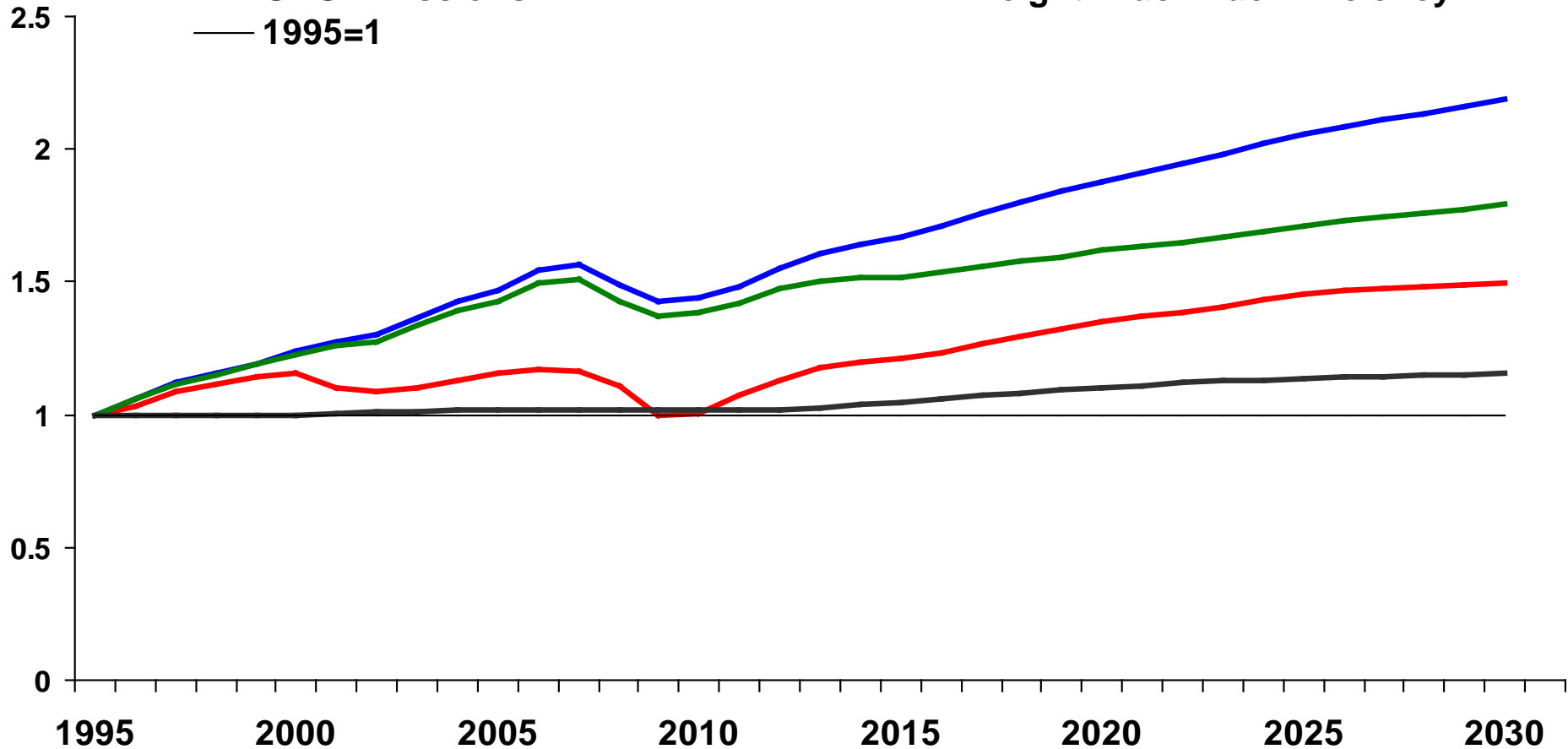
Source: Annual Energy Outlook 2009 Updated Reference Case d041409a

Heavy Truck GHG Emissions by Fuel Type (Million Metric Tons CO₂ Equivalent)



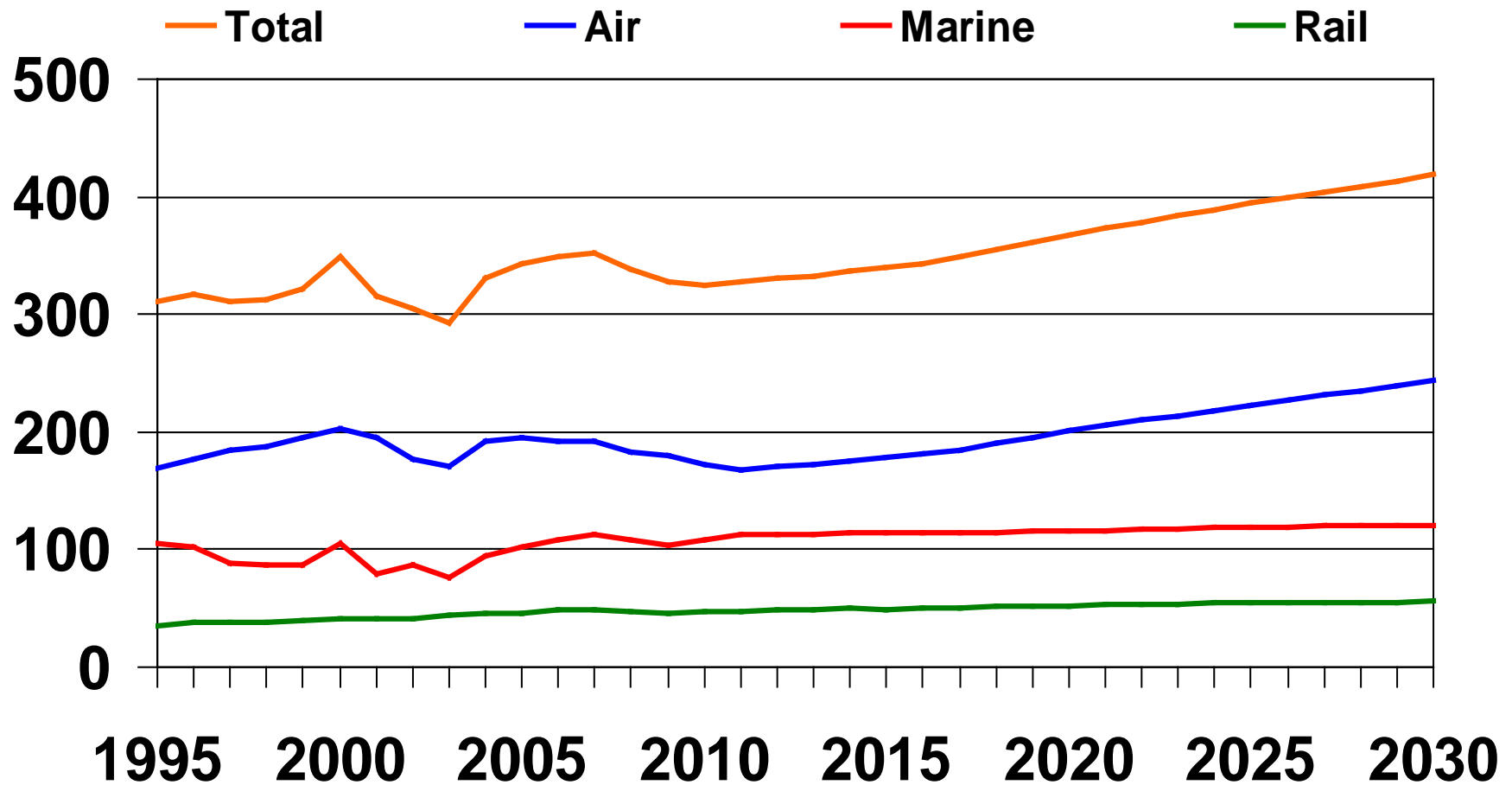
Heavy Truck Vehicle Miles Travelled, Industrial Value of Shipments, and Fuel Efficiency

- Billion Vehicle Miles Traveled
- Industrial Output
- GHG Emissions
- Freight Truck Fuel Efficiency
- 1995=1

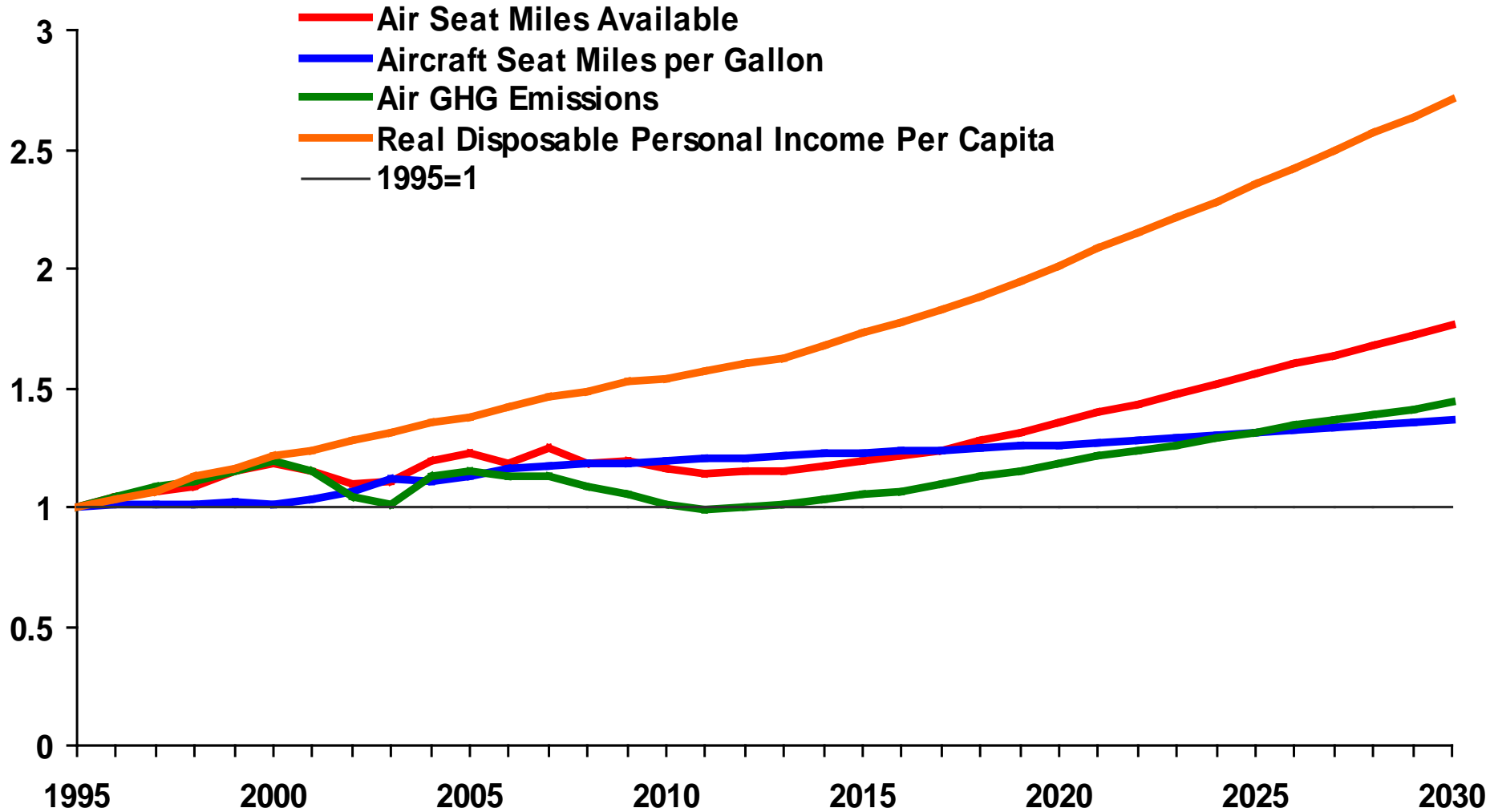


Non-Highway GHG Emissions by Mode

(Million Metric Tons CO₂ Equivalent)



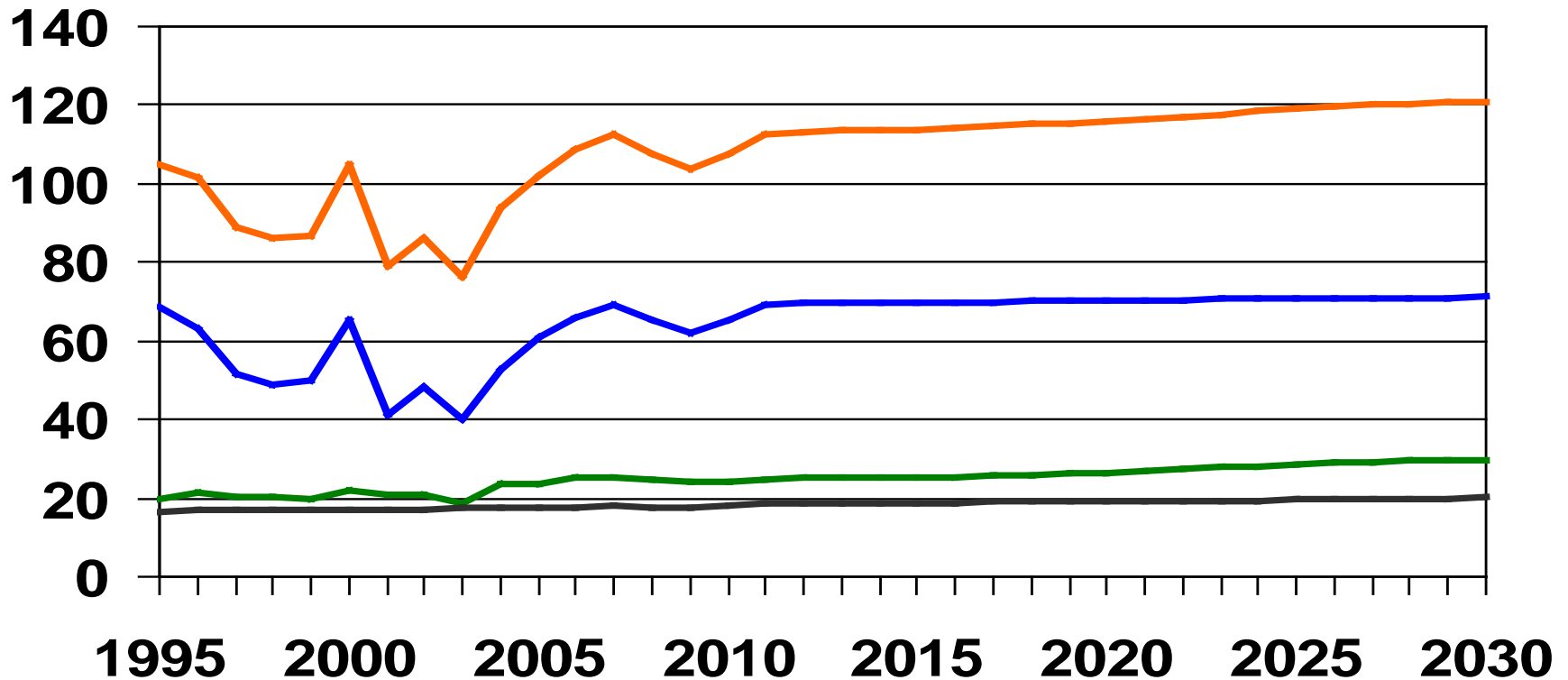
Air Travel Demand, Energy Efficiency, GHG Emissions, and Income



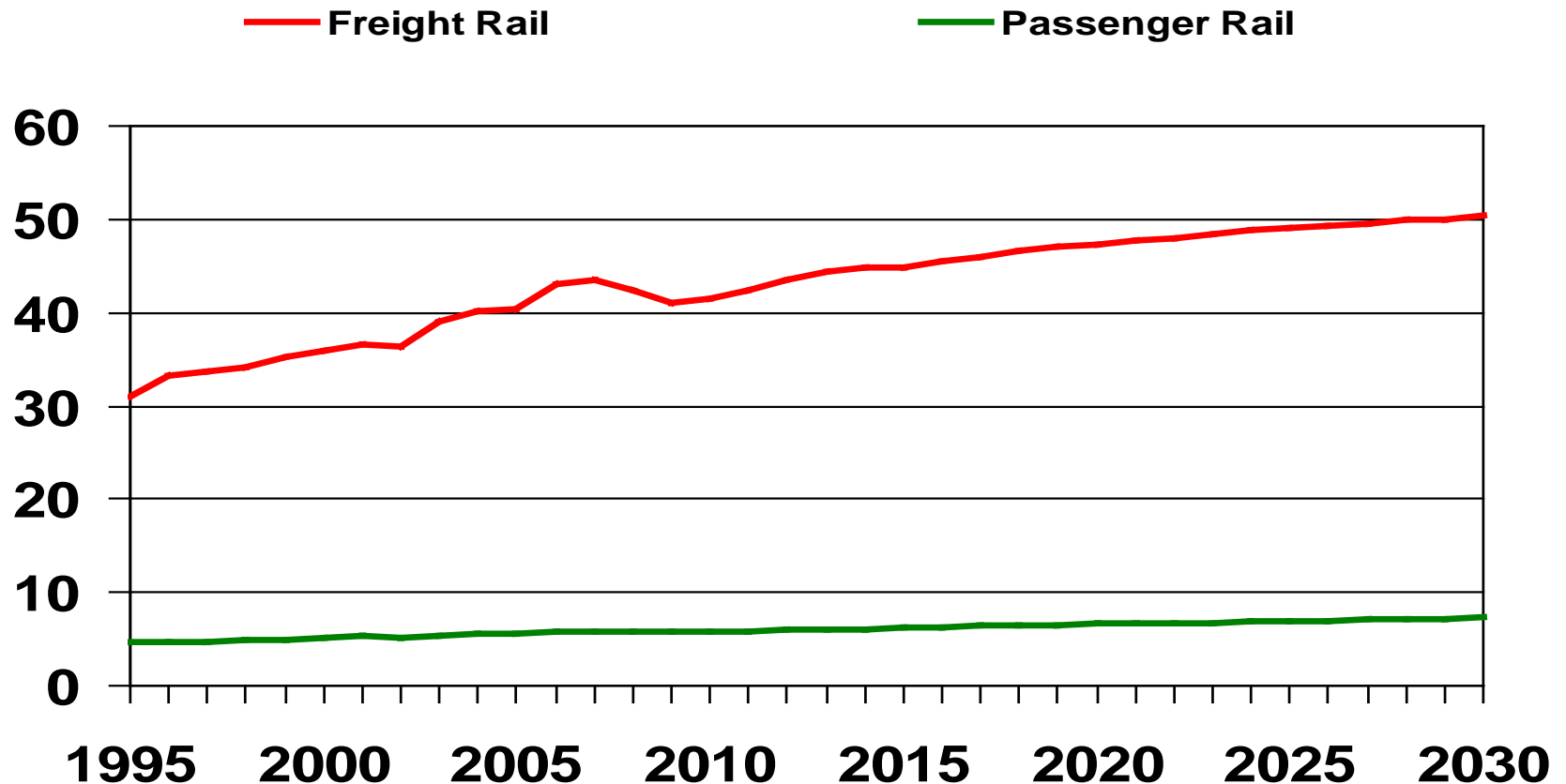
Source: *Annual Energy Outlook 2009* Updated Reference Case d041409a

U.S. Marine GHG Emissions by Mode (Million Metric Tons CO₂ Equivalent)

— Total
— Domestic Shipping
— International Shipping
— Recreation Boats



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



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.



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Questions?

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