Energy Use in Goods Movement:
Trends and Inter-Modal Comparisons

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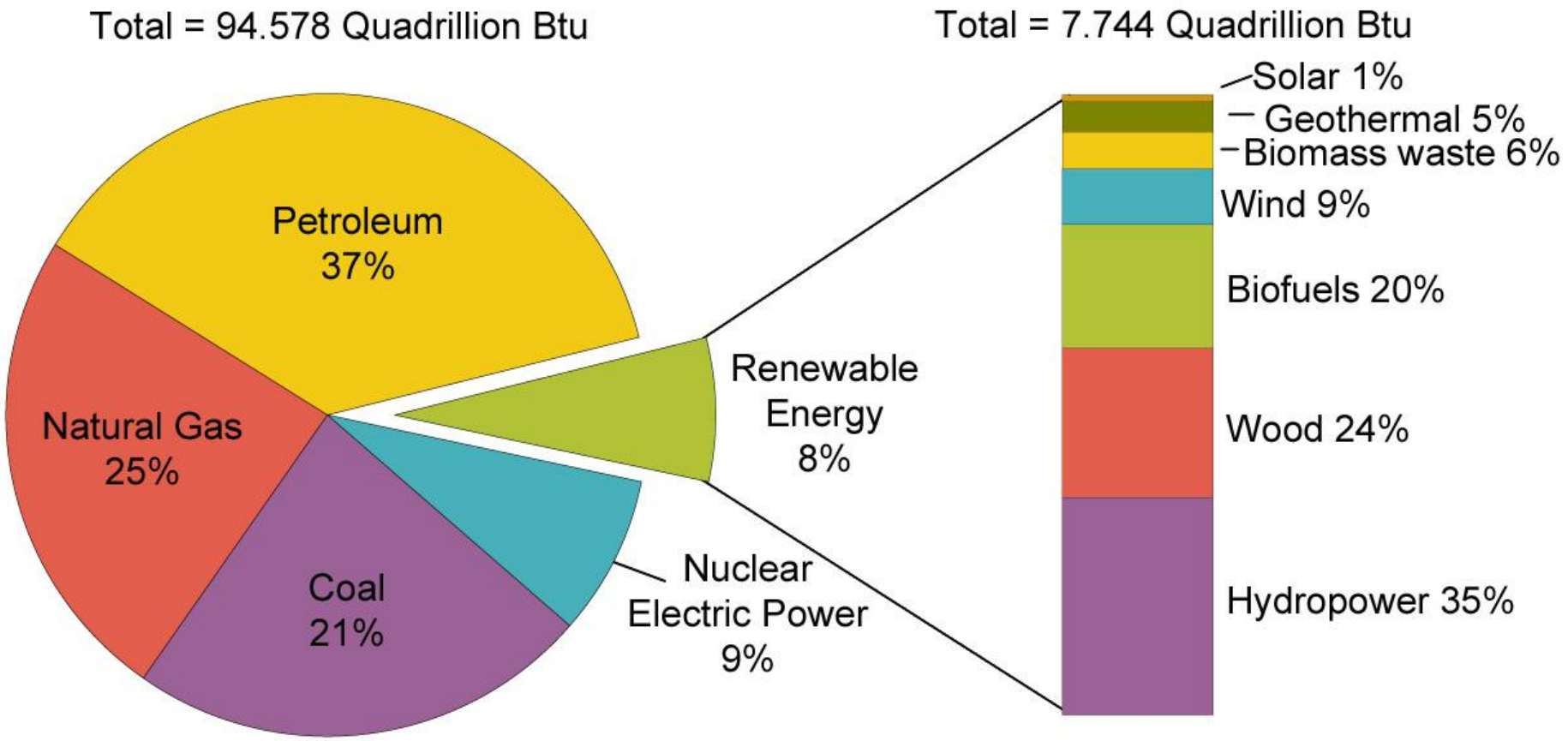
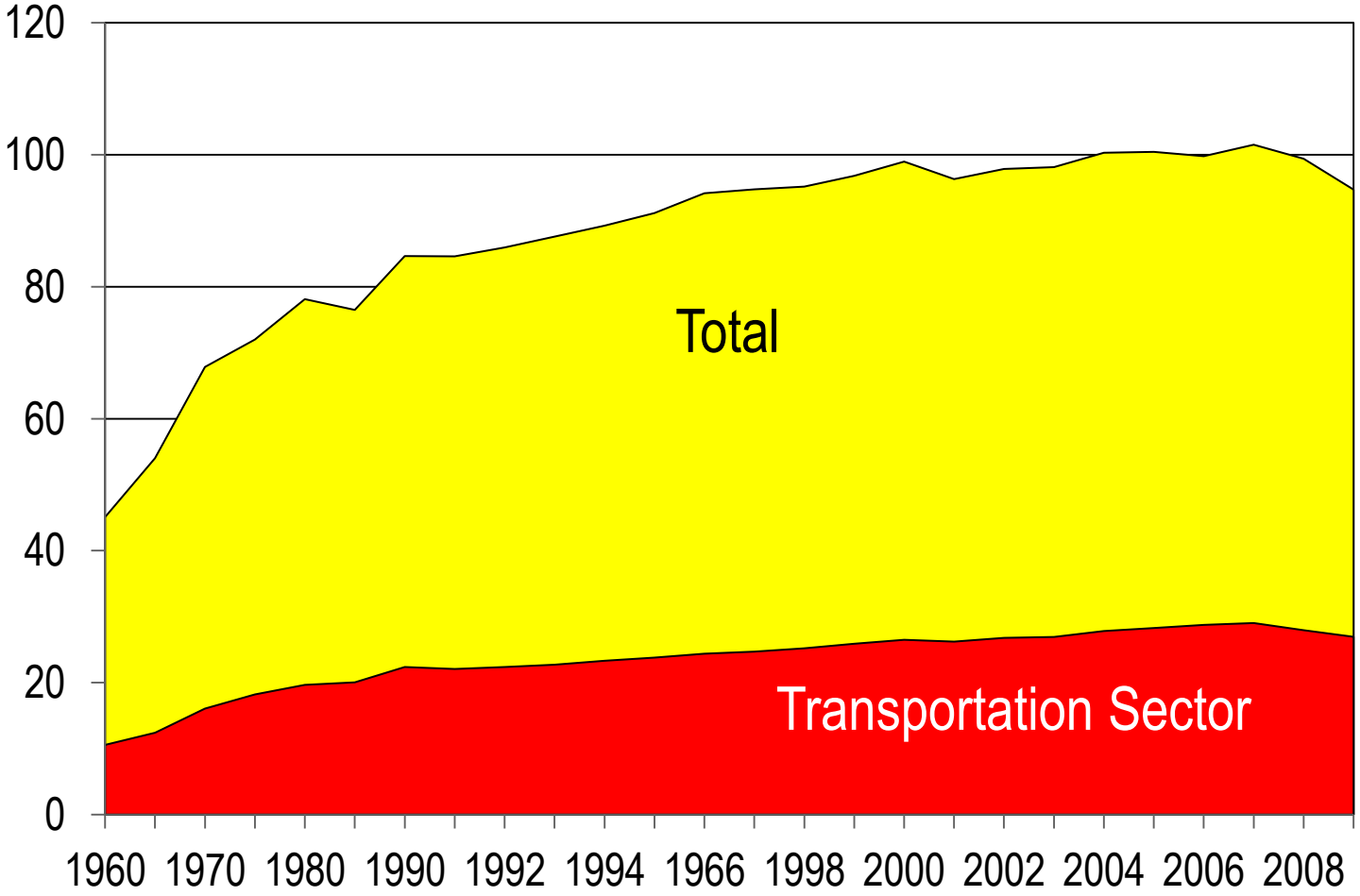
U.S. Energy Consumption by Energy Source, 2009



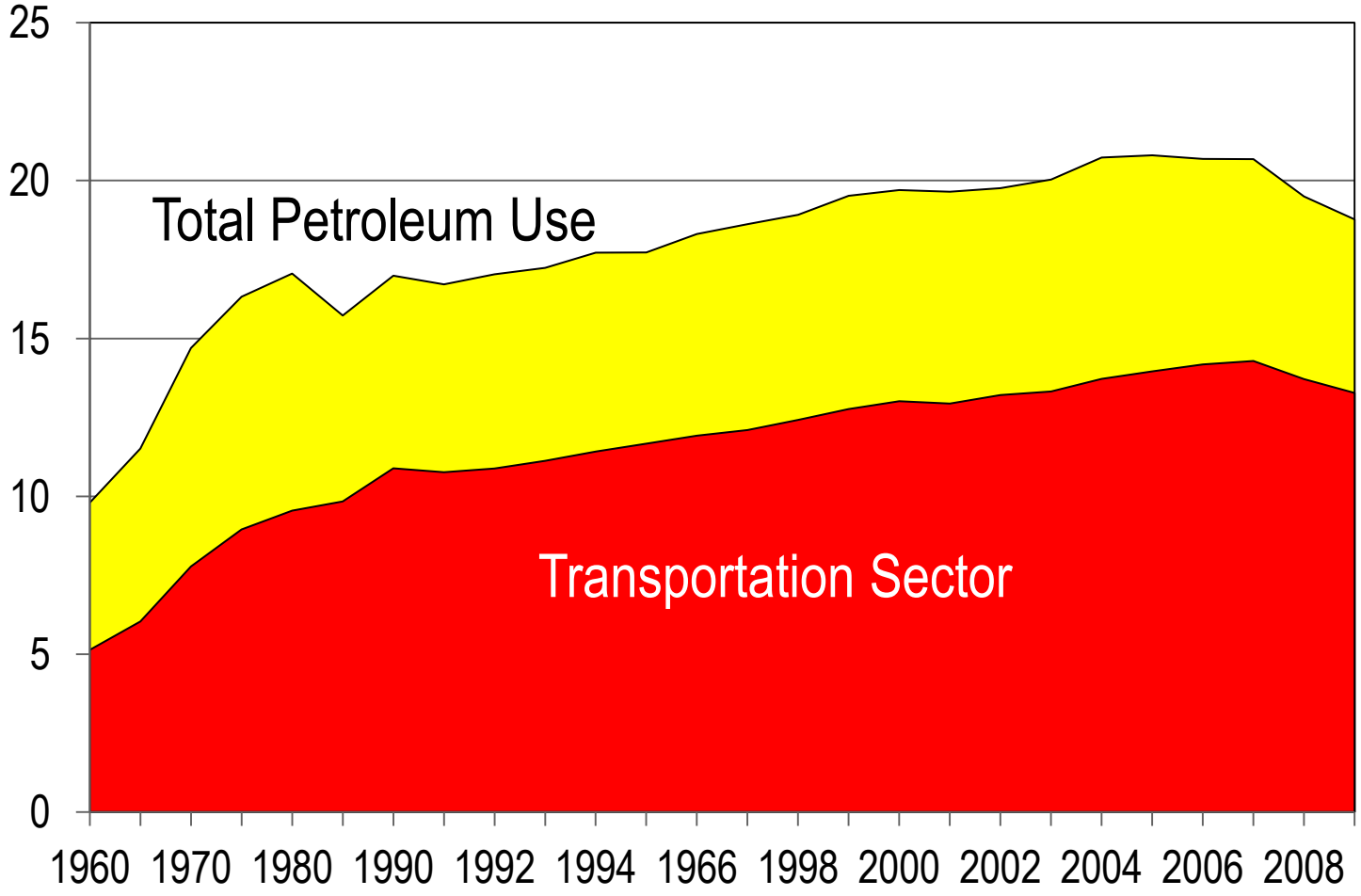
Note: Sum of components may not equal 100% due to independent rounding.
Source: U.S. Energy Information Administration, *Annual Energy Review 2009*, Table 1.3, Primary Energy Consumption by Energy Source, 1949-2009 (August 2010).

U.S. Consumption of Energy
(quadrillion BTU)



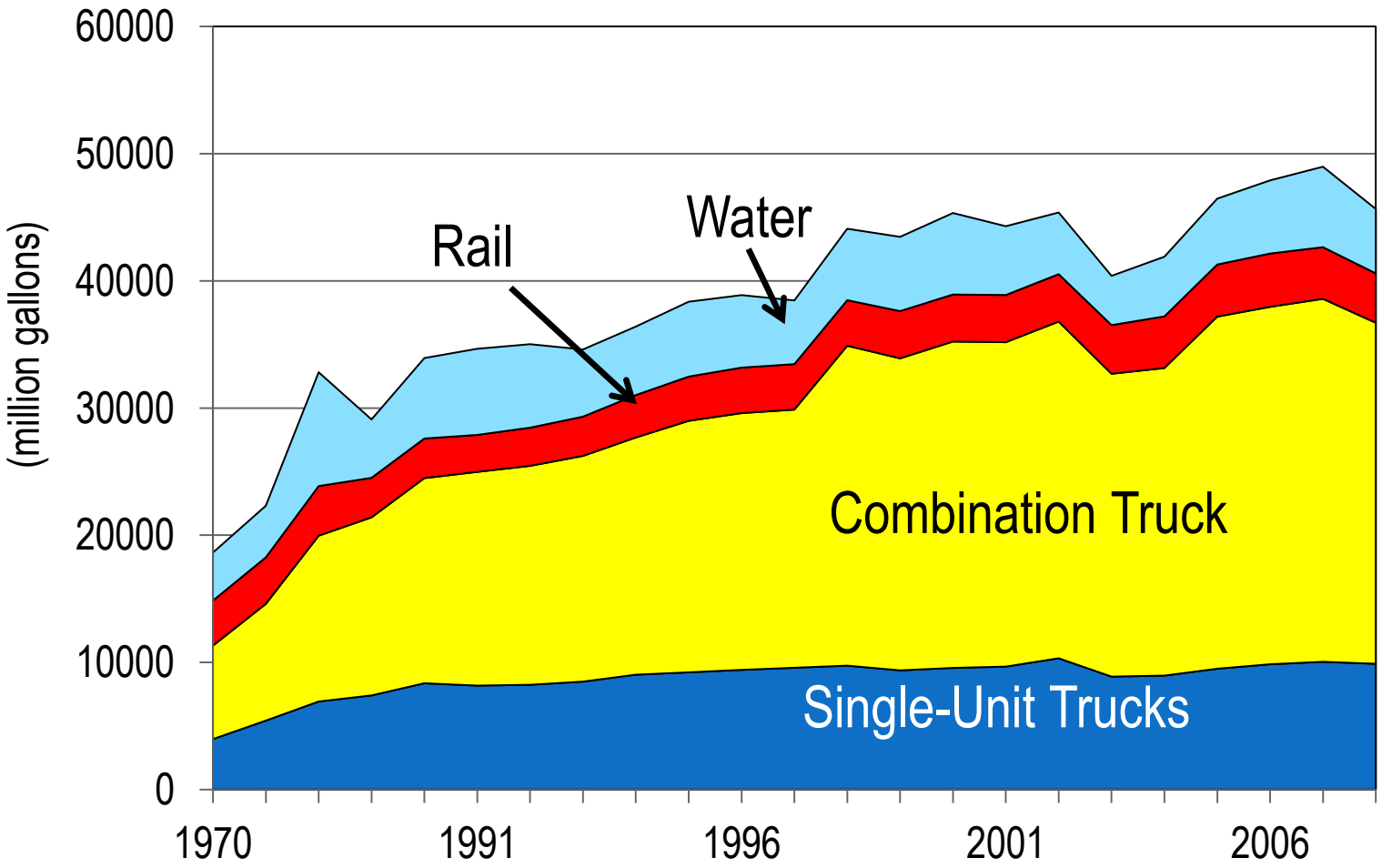
Source: Bureau of Transportation Statistics

U.S. Petroleum Consumption
(millions of barrels per day)



Source: Bureau of Transportation Statistics

Fuel Consumption by Sector

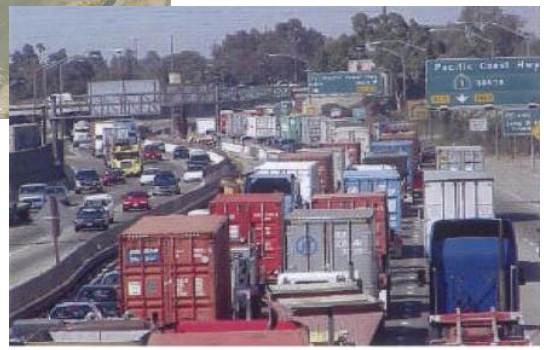


Source: Bureau of Transportation Statistics

Container Movement – Truck vs. Rail

Number of Containers Per Train

- According to the Association of American Railroads:
  - Single Freight Train = 280 or More Truck Trips
  - Rail – 2 to 4 Times More Efficient than Trucks on per Ton-Mile Basis
  - Rail - 2 to 3 Times Cleaner per Ton-Mile Basis



Source: Association of American Railroads

Container Movement – Short Sea Shipping vs. Trucks

Short Sea Shipping Proposals

- Diversion of Cargo from Freeways by Water Along Coastal Routes
- May Be Limited to Non-Time Sensitive Cargo Deliveries
- Should Use the Cleanest Marine Vessels

Container Deliver Methods from Southern California Ports

Delivery by Truck

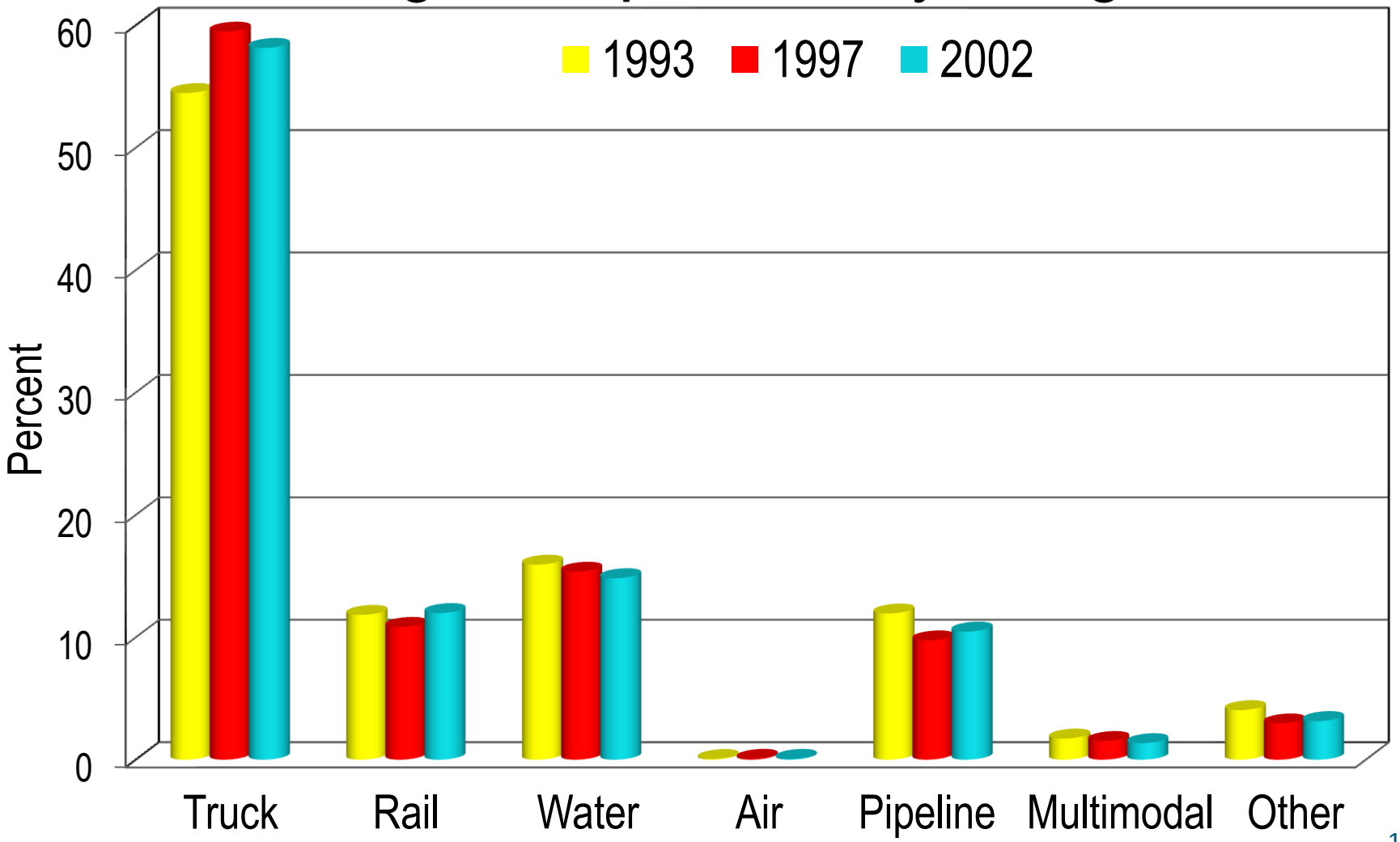
Breakeven Zone

Potential Intermodal

Delivery by Rail

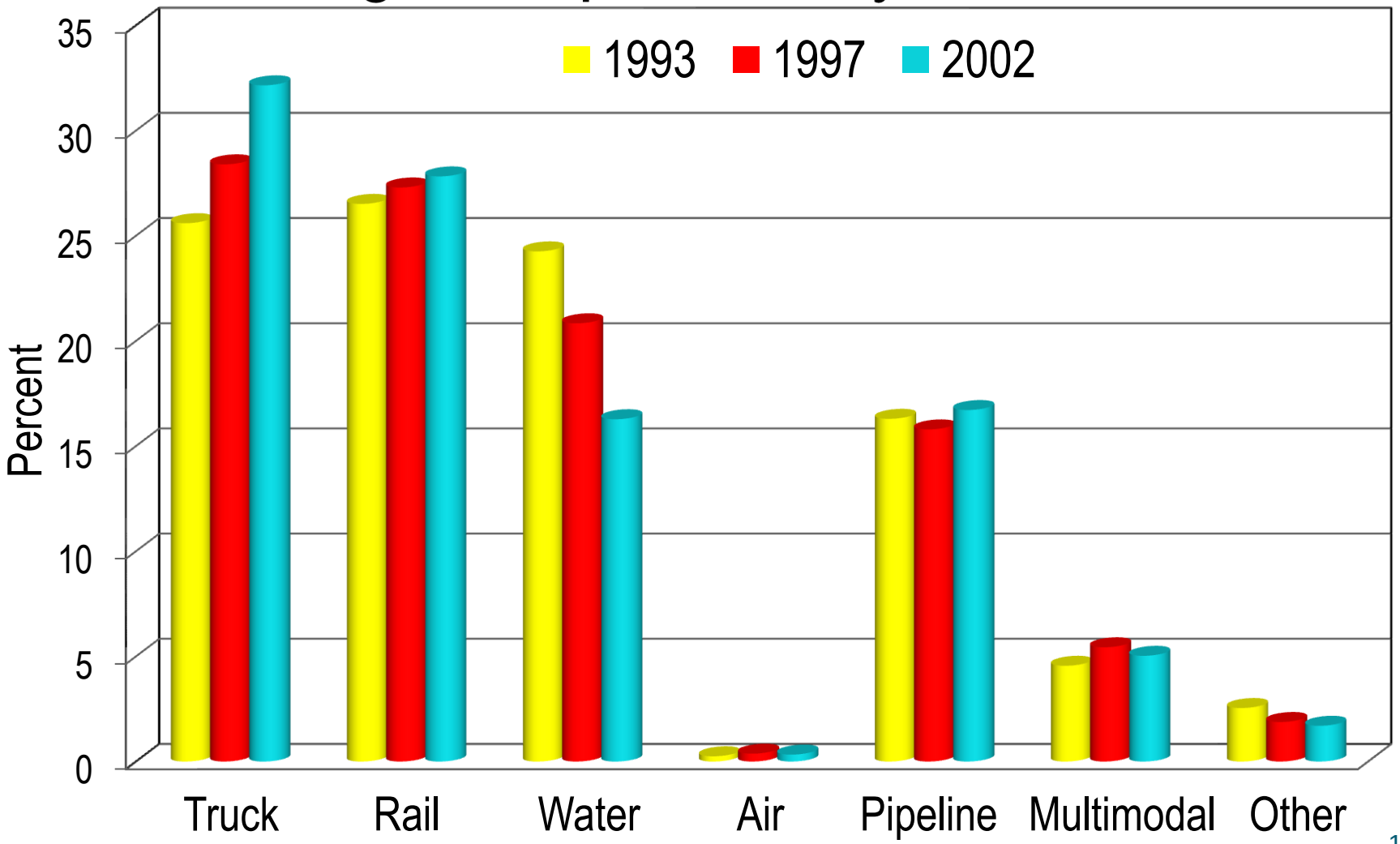
Source: Port of Los Angeles (2003)

Modal Shares of U.S. Commercial Freight Shipments by Weight



Source: Bureau of Transportation Statistics

Modal Shares of U.S. Commercial Freight Shipments by Ton-Miles



Source: Bureau of Transportation Statistics

Technological Solutions

- Greater Deployment of the Cleanest Engine Technologies
- Greater Use of Alternative Fuels and Renewable Fuels

Alternative Fuels and Renewable Fuels Use

What are Renewable Fuels?

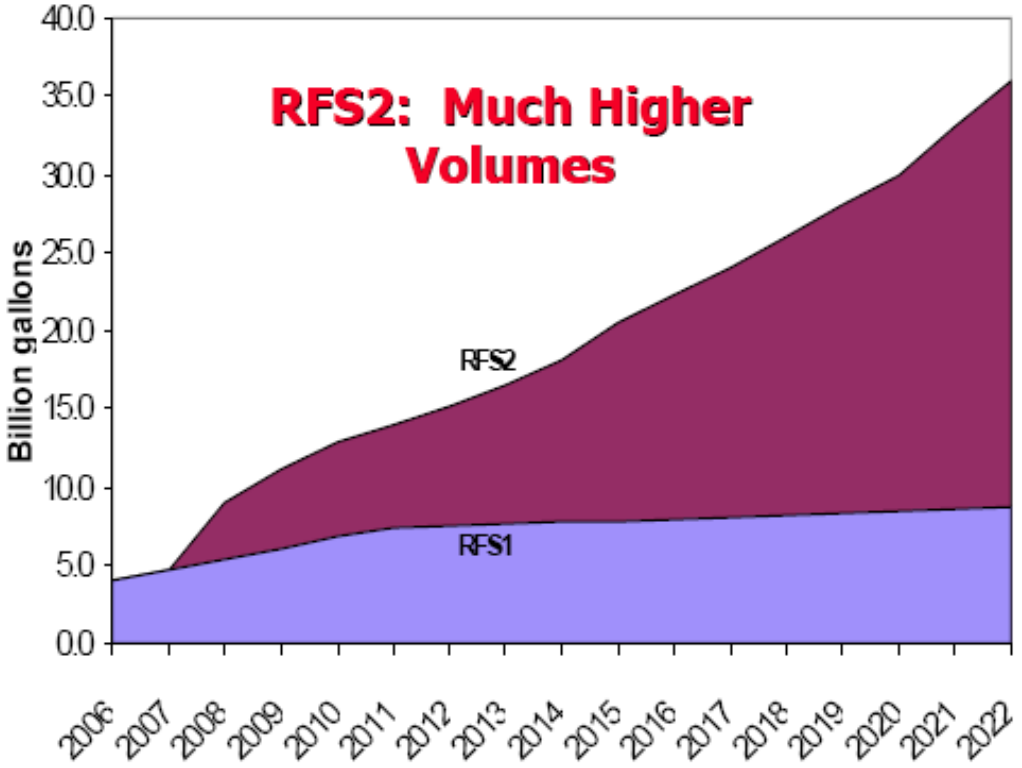
- Any fuel produced from renewable sources (e.g., biomass, waste, wind, solar, etc.)
- Examples
  - Ethanol
  - Biodiesel
  - Methane from Biomass, Waste
  - Gas-to-Liquid Fuels
  - Hydrogen
  - Electricity from Renewable Sources

Policy Drivers

- Energy Policy Act of 2005 – Renewable Fuel Standard
  - 4.0 billion gallons/yr in 2006 growing to 7.5 bgy in 2012 (***Note: U.S. gasoline use in 2006 – 140.1 billion gals; California gasoline use in 2006 – 15.9 billion gals***)
- Energy Independence and Security Act of 2007
  - Increased Volumes
  - 4 New Standards

Energy Independence and Security Act of 2007 (EISA)

- **Modifies 2005 RFS Program**
  - Volumes increase to 36 Bgal/yr by 2022
  - Establishes new renewable fuel categories and eligibility requirements
  - Provides new waivers and paper credit provisions
  - Includes new obligated parties
- **Includes new studies and reports**



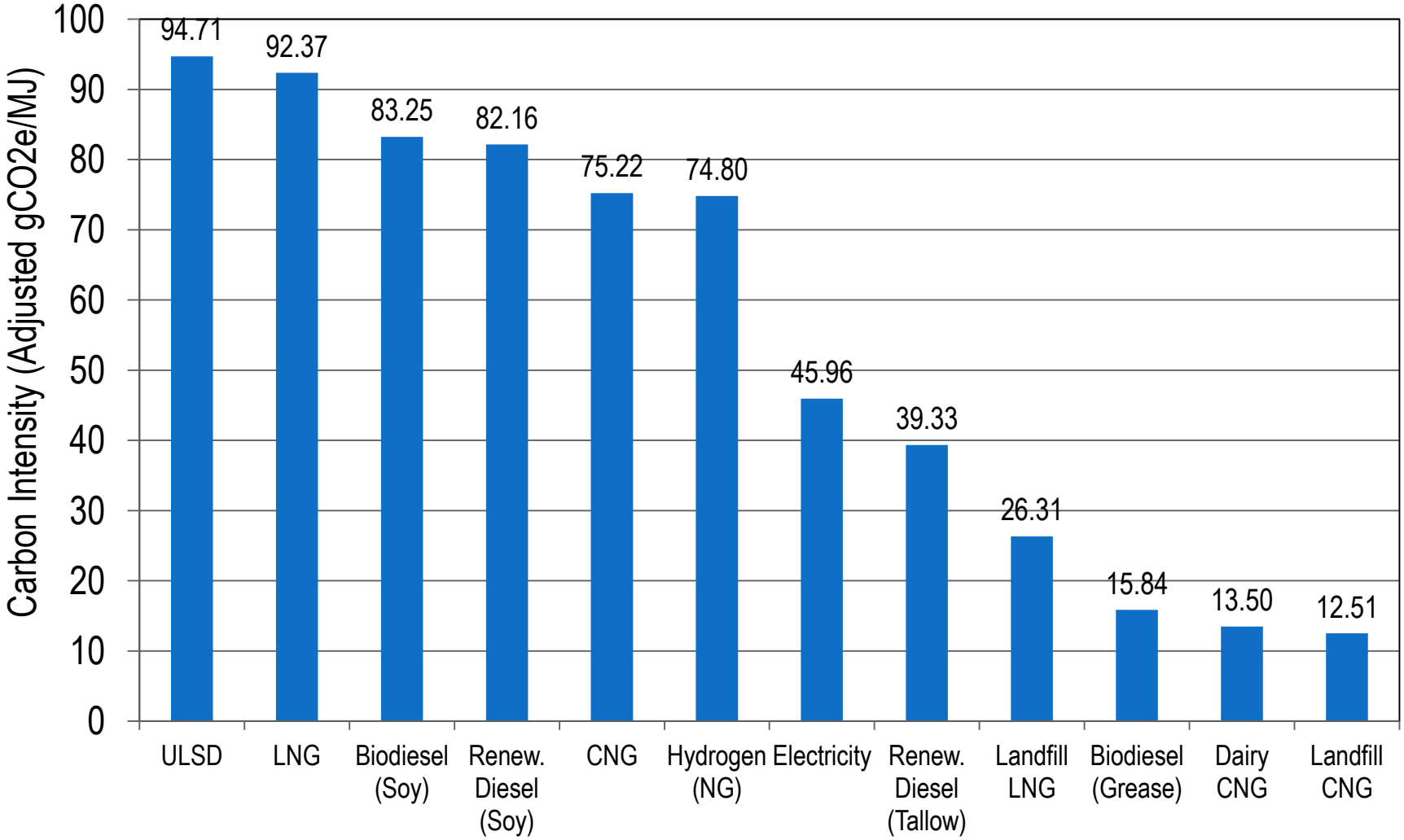
EISA – Four New Standards

- **Cellulosic Biofuel: 16 billion gallons by 2022**
  - Cellulosic ethanol, BTL diesel, green gasoline, etc.
  - Must meet a 60% lifecycle GHG threshold
- **Biomass-Based Diesel: 1 billion gallons by 2012 and Beyond**
  - Must meet a 50% lifecycle GHG threshold
- **Advanced Biofuel: 21 billion gallons by 2022**
  - Includes cellulosic biofuels and biomass-based diesel plus an additional 4 billion gal
  - Essentially anything but corn starch ethanol
  - Must meet a 50% lifecycle GHG threshold
- **Total Renewable Fuel: 36 billion gallons by 2022**
  - Includes up to 15 billion gallons conventional biofuel (ethanol derived from corn starch or any other qualifying renewable fuel)
  - Must meet 20% lifecycle GHG threshold
  - Only applies to new fuel production capacity

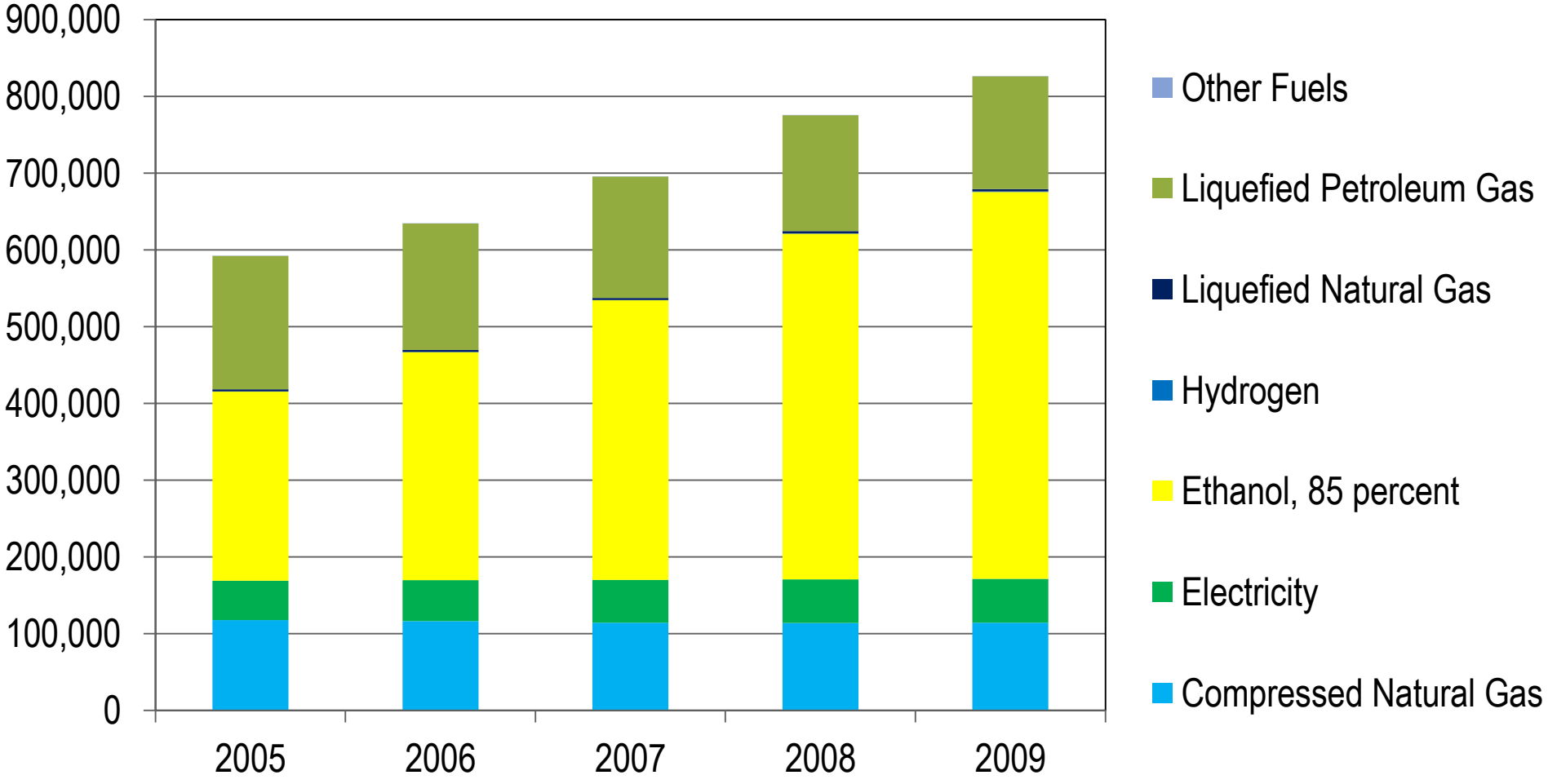
California Low Carbon Fuel Standard

- LCFS established January 2007
- ARB Board Adopted – April 2009
- 10% reduction in carbon intensity by 2020
- Estimated 16 MMT reduction in GHG emissions by 2020
- Achieves about 10% of the total emission reductions required to meet the AB 32 target

Carbon Intensities of Various Heavy-Duty Vehicle Fuels

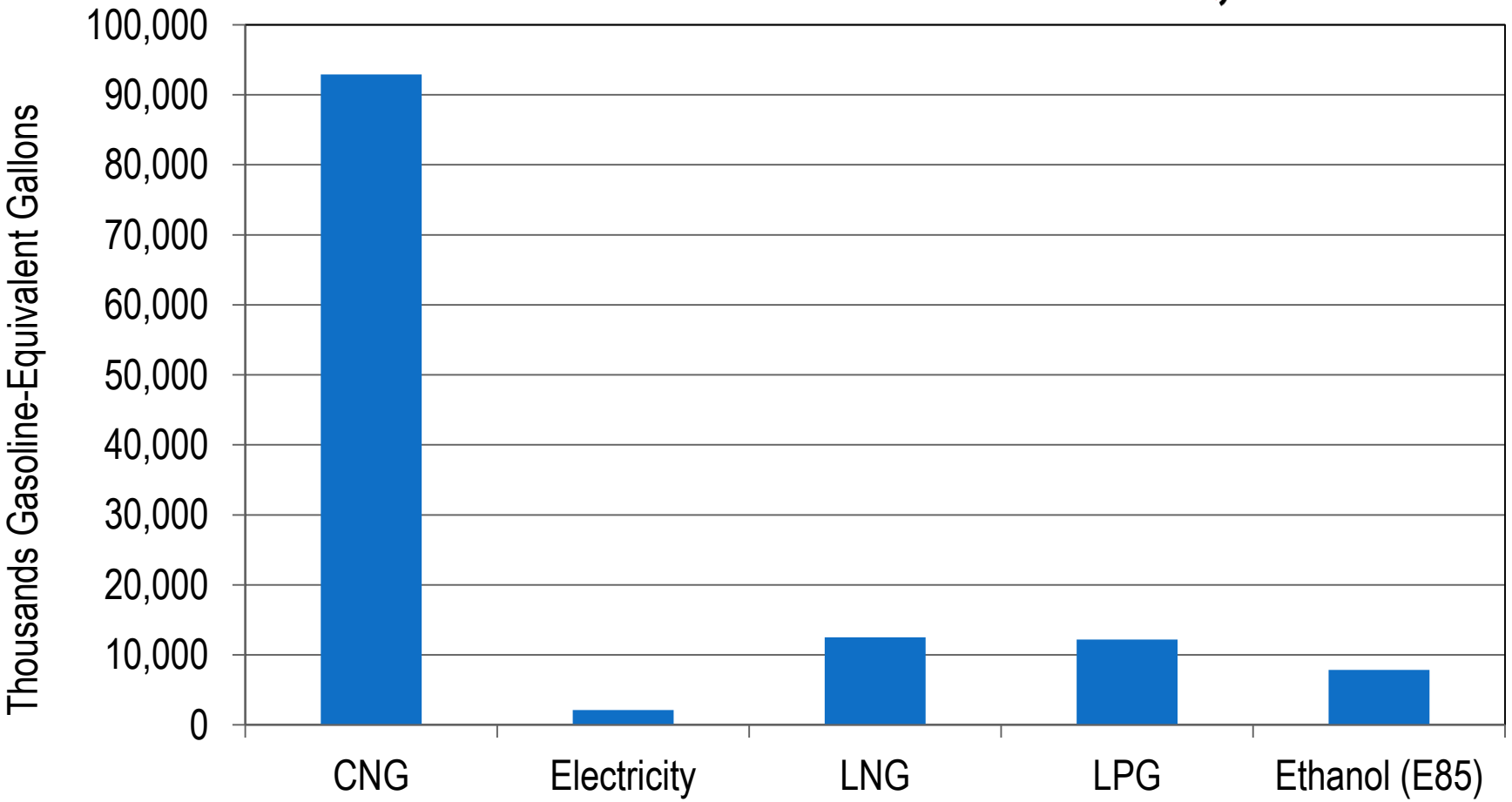


Estimated Number of Alternative Fuel Vehicles



Source: U.S. EIA (2011)

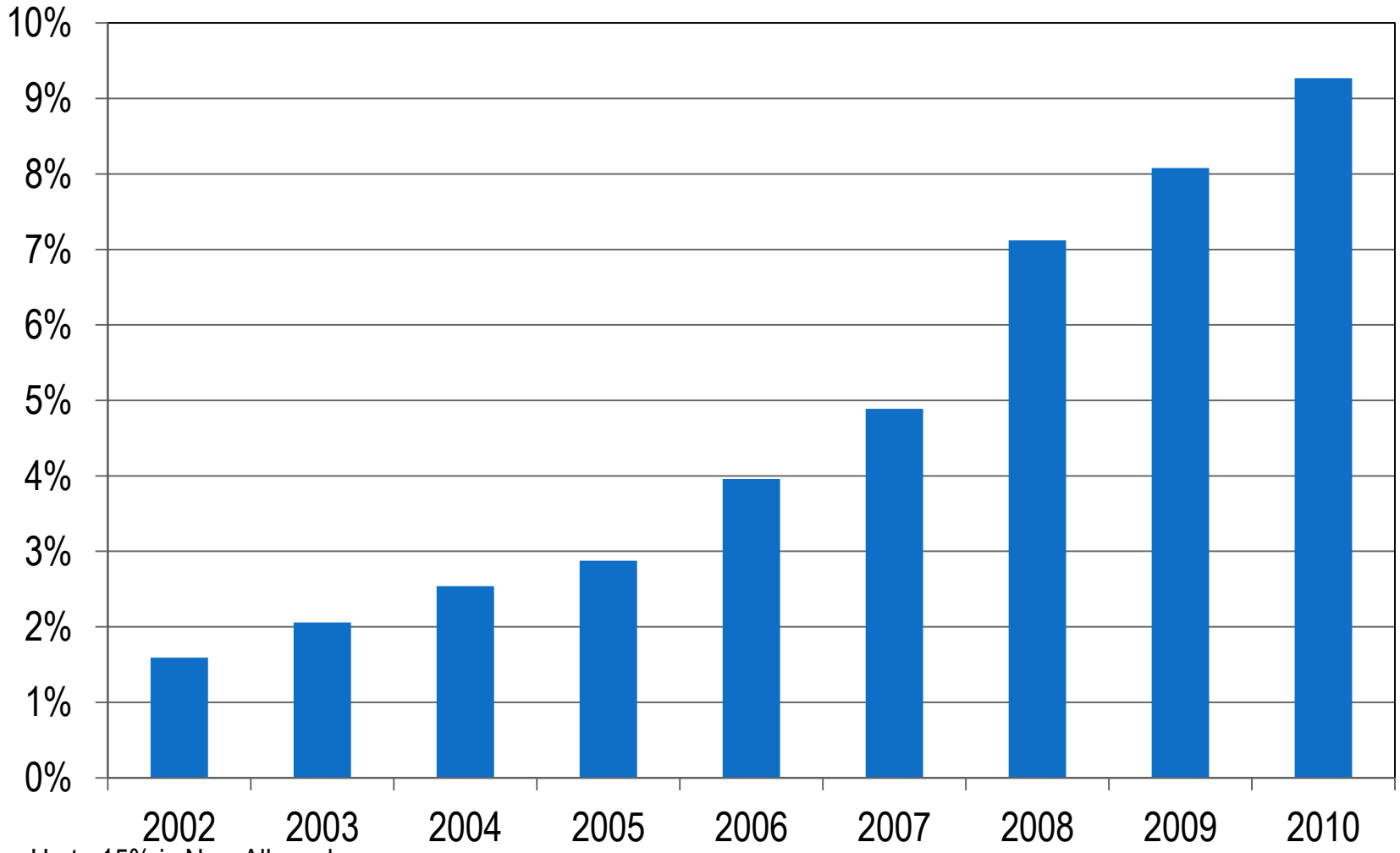
Estimated Consumption of Alternative Fuels in California, 2009*



*Note: Total Gasoline Sale in 2009 - 14.8 billion gals

Source: U.S. EIA (2011)

Percentage of Ethanol in U.S. Gasoline*



* Note: Up to 15% is Now Allowed

Source: U.S. EIA (2011)

Summary

- Intermodal Diversion
  - Historically, Based on Business Case
  - Environmental Concerns – Dictate Need for Change
- Must Deploy the Cleanest Engine Technologies
- Greater Use of Alternative Fuels and Renewable Fuels