

# **Diesel Fuel : Use, Manufacturing, Supply and Distribution**

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Emissions Research Conference**

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# Diesel Fuel: Use, Manufacturing, Supply and Distribution

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- **Key Considerations**
- **Diesel Fuel Manufacturing and Supply**
  - **US vs Europe**
  - **Diesel production technologies**
- **Diesel Fuel Markets**
- **Vehicle Issues**
  - **Light Duty Diesel (LDD) vehicle markets**
- **Summary/Conclusions**

# Diesel Fuel: Use, Manufacturing, Supply and Distribution

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## Key Considerations

- US refineries are designed to maximize gasoline production
  - To respond to consumer demand
  - US diesel demand is driven by heavy-duty applications
- European refineries are designed to maximize diesel production
  - Diesel as the primary transportation fuel
  - Heavily influenced by tax incentives for diesel
  - Europe now importing diesel and exporting gasoline

# Diesel Fuel: Use, Manufacturing, Supply and Distribution

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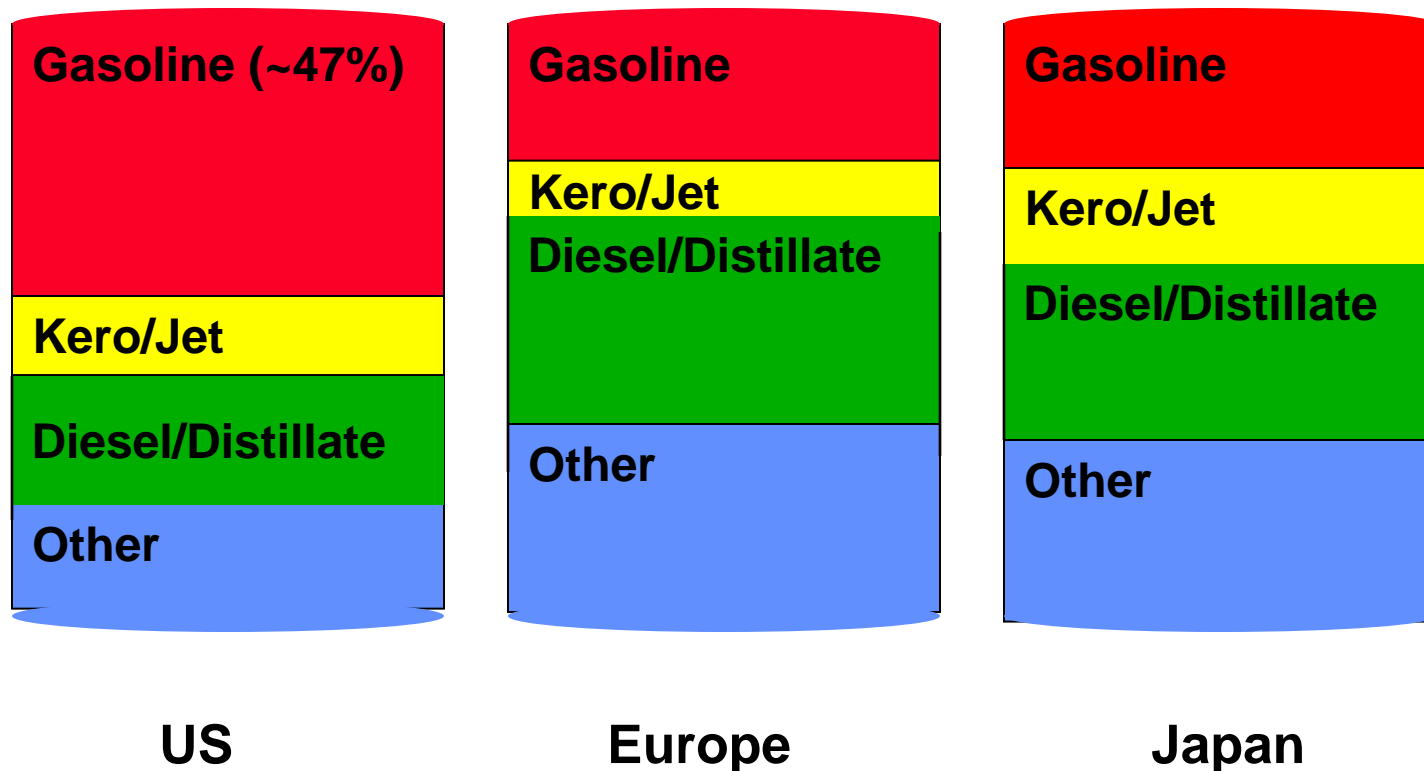
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## Key Considerations (Continued)

- Refinery design and equipment differences
  - Between refineries designed for maximum gasoline production versus those designed for maximum diesel production
- A major switch to diesel production in the US would require significant refinery re-design
- There are many options other than increased LDDs for improving fuel economy

# Refinery “Cut of the Barrel”: US vs Europe vs Japan

US Refineries Are Designed and Constructed for Gasoline Production



# Fuel Manufacturing and Supply: US vs Europe

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- **Refinery design and equipment differences**
  - **Between refineries designed for maximum gasoline vs those designed for maximum diesel**
  - **Gasoline: Catalytic cracking → Volume & Octane**
    - ✓ 37% of US crude capacity
    - ✓ 15% of Europe's crude capacity
  - **Diesel: Hydrocracking → Volume & Cetane**
    - ✓ Increased by approx. 60% between 1995 and 2005
- **A major switch to diesel production in the US would:**
  - **Require significant refinery re-design and major process unit installations**
  - **Cost \$500 million to \$1 billion at many refineries**
  - **Require substantial lead time, e.g., 5 - 10 years**

# Diesel Fuel Markets

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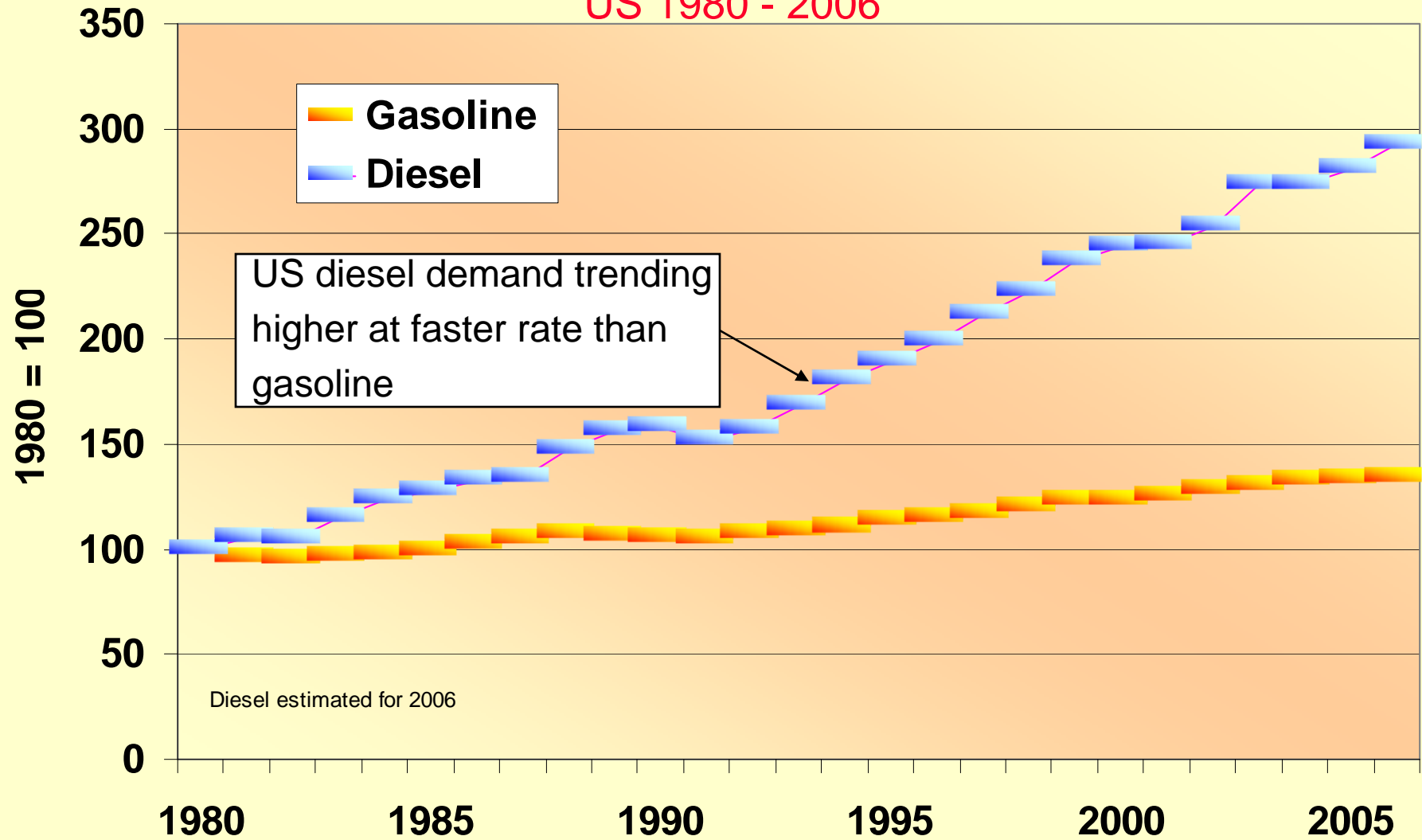
## Several Factors Have Caused a Tightening of Worldwide Diesel Supply

- Diesel demand in Europe has grown as diesel vehicles replaced gasoline vehicles.
  - **Different tax treatment**
  - **Less severe vehicle emissions standards**
  - **Improved diesel vehicle performance**
- Diesel demand has also been growing worldwide
  - **Heavy duty diesel demand grows as the economy grows**
- US highway diesel demand has been growing at a faster rate than gasoline demand



# Demand Trends: Gasoline Versus Highway Diesel

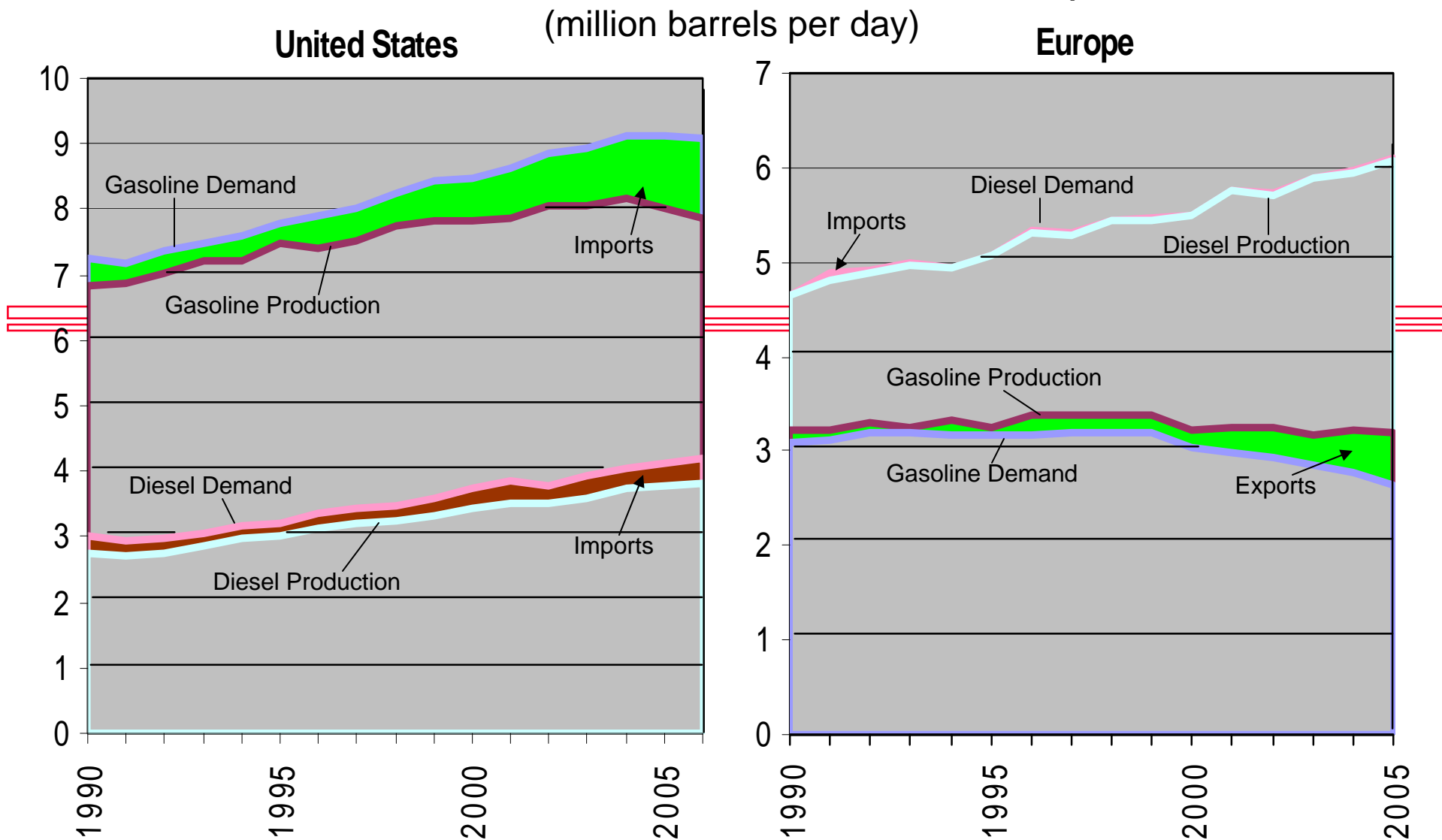
US 1980 - 2006



Source: EIA and API Statistics

## As Diesel Demand Grew in Europe, Gasoline Became Surplus and Was Exported, Much to US

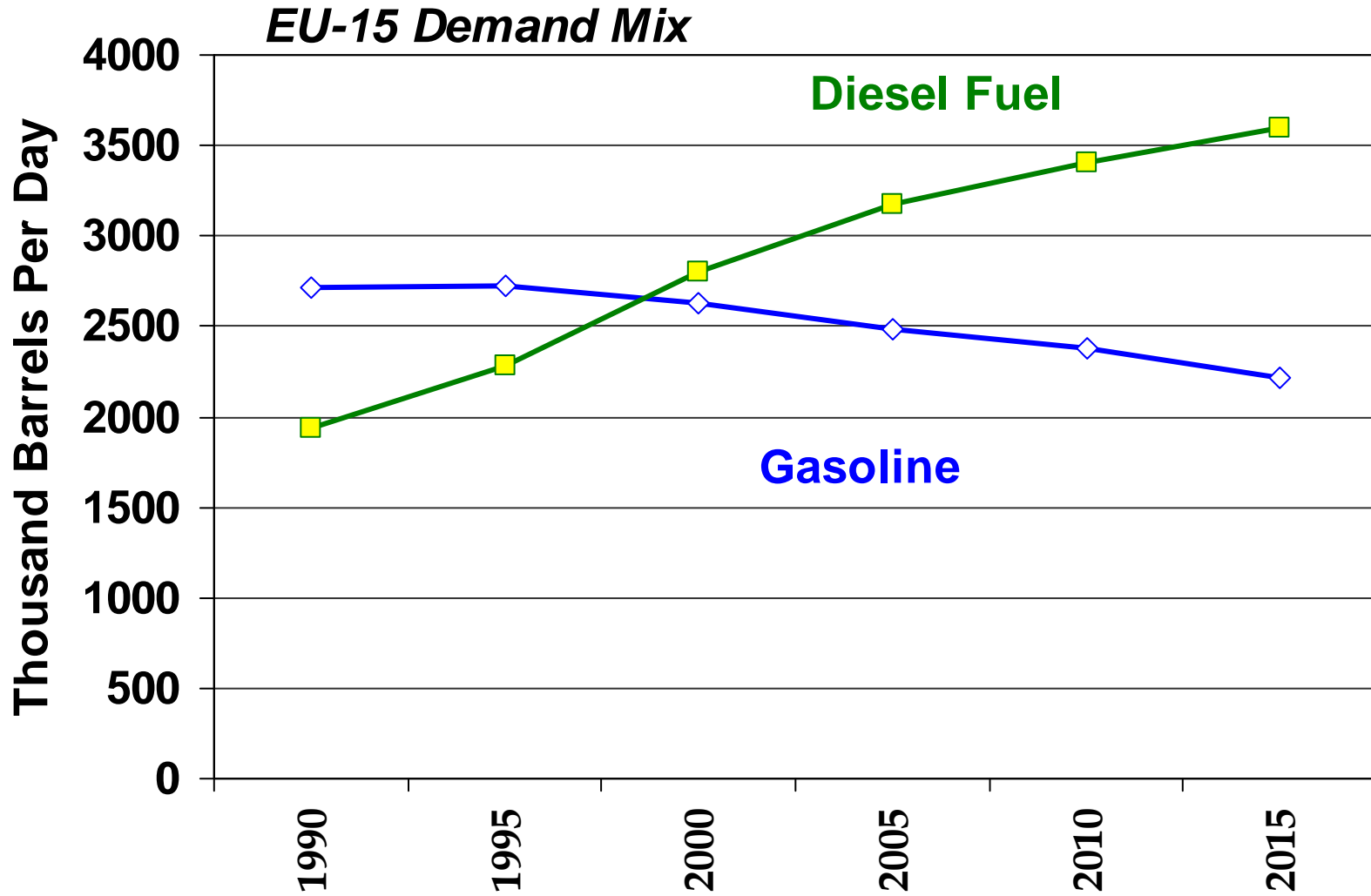
Production versus Demand of Motor Gasoline and Diesel in Europe and the US



Source: IEA, EIA  
Assumed constant stocks



# EU-15 Demand Mix Forecast Shows Continued Declining Gasoline Demand Which Benefits US



Source: EIA, History IEA; Forecast Purvin & Gertz



# Challenges to US Light Duty Diesel Growth

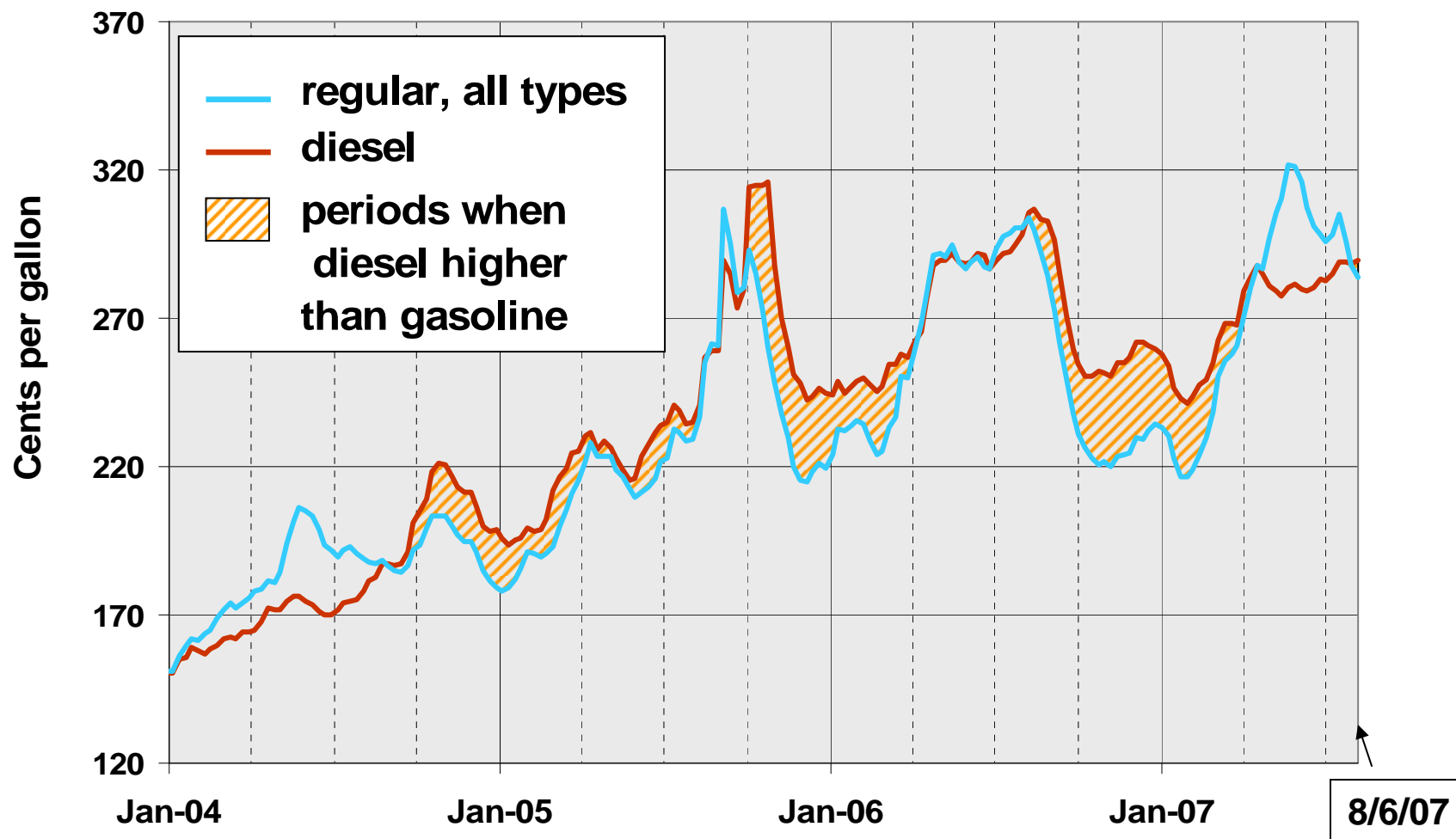
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- EPA and CARB emissions standards are challenging
- Consumer acceptance is uncertain
- Diesel fuel consumer cost savings advantage over gasoline vary

# US Diesel Prices Are Sometimes Higher Than Gasoline

## Retail Diesel vs. Gasoline Prices



Source: Energy Information Administration

# LDD Vehicles Are One of Several Possible Options for Improved Fuel Efficiency

- Consumers will decide on acceptance of options based on the:
  - **Cost of vehicles**
  - **Cost of fuels**
  - **Potential for recovery of incremental vehicle costs through improved fuel economy**
- Cost – Effectiveness of Some Potential Options

	Fuel Economy Benefit, %	Cost, \$
Improved Conventional Gasoline	26 - 28	800 -1,000
Hybrids	25 - 55	3,900 -5,600
Diesel	33 - 50	2,200 – 3,400

Source: K. G. Duleep, Energy and Environmental Analysis, Testimony at House Science Committee, and 2005 SAE Government/Industry Presentation

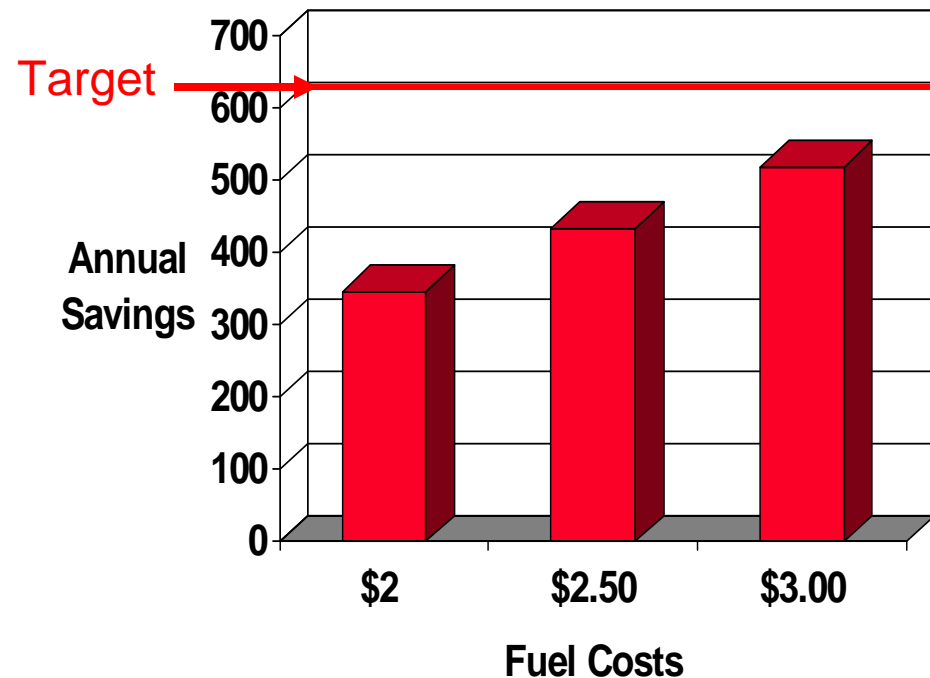
# Cost Recovery Scenarios

## Gasoline = Diesel

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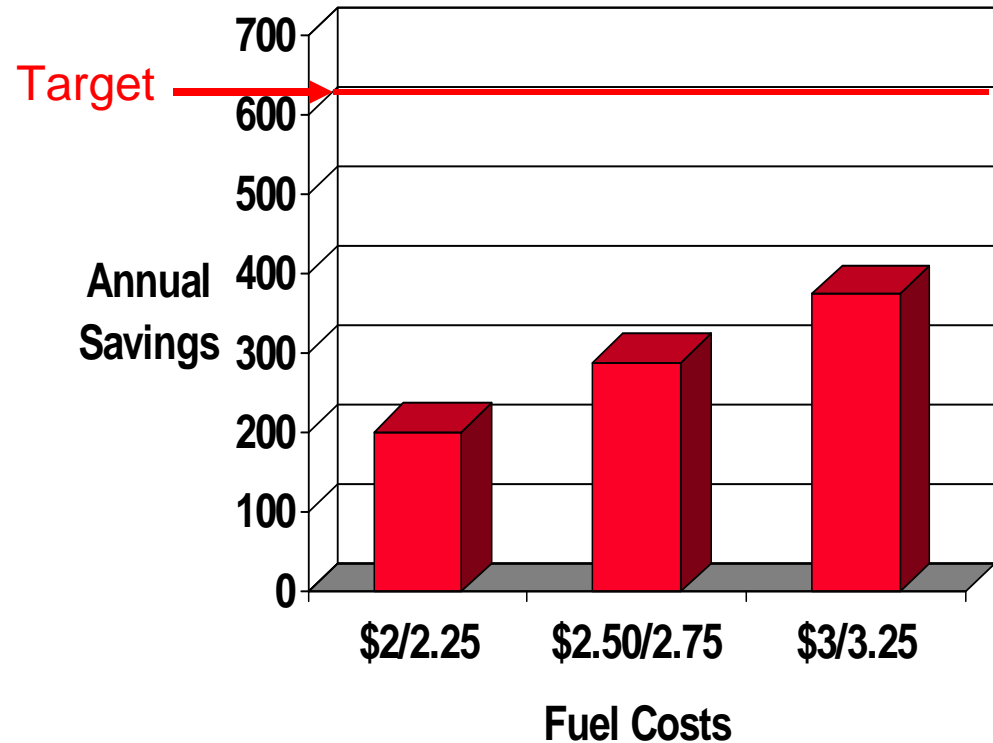
- Assumptions:
  - » 15,000 mi/yr
  - » Diesel vs Gas MPG = 26 vs 20 (30%)
  - » \$3,000 price premium for diesel engine
  - » 5-year payback target



# Cost Recovery Scenarios

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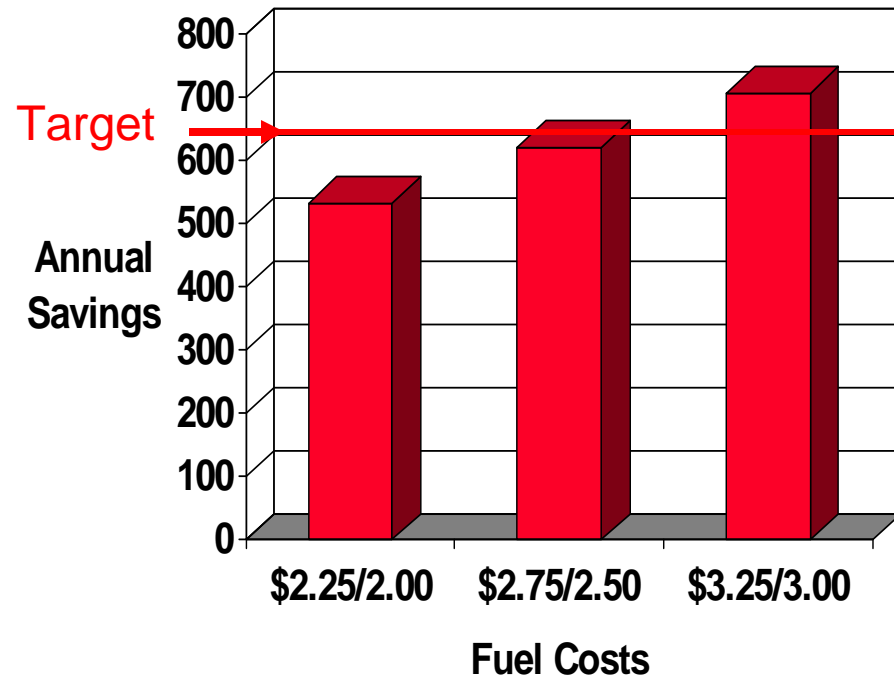




# Cost Recovery Scenarios

## Gasoline > Diesel

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# Summary/Conclusions

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- US refineries are designed to maximize gasoline production
- European refineries are designed to maximize diesel production
- A major switch to diesel production in the US would require significant investment and many years for design and construction.
- Significant challenges exist for increased passenger car diesel growth in the US
- Consumers will decide on acceptance of options based on:
  - » Cost of vehicles
  - » Cost of fuels
  - » Potential for recovery through improved fuel economy