Reduction of Heavy-Duty Fuel Consumption and CO₂ Generation

What the Industry Does and What the Government Can Do

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Daimler Trucks - Overview

- World’s leading truck manufacturer
- Vehicle brands include **Mercedes-Benz**, **Freightliner**, **Western Star**, **Thomas Built Buses**, and **Mitsubishi Fuso**.
- Component brands include **Mercedes Benz**, **Detroit Diesel**, and **Mitsubishi Fuso**
- **33 production sites** in NAFTA region (16), Europe (7), South America (1), Asia (8), and Africa (1)
- Product range covers **light, medium, and heavy trucks** for local and long-distance deliveries and construction sites, as well as special vehicles for municipal applications
- Primary sales markets in 2008 were Asia (with 33% of unit sales), the NAFTA region (21%), Western Europe (18%), and Latin America excluding Mexico (13%)

**Facts & figures:**

- Daimler Trucks Headquarters Stuttgart, Germany
- Employees 79,415 (December 31, 2008)
- EBIT EUR 1,607 million (FY 2008)
- Revenues EUR 28.6 billion (FY 2008)
- Unit sales 472,100 units (FY 2008)
- Responsible Board of Management Member Mr. Andreas Renschler
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Criteria pollutants reductions over time

Source: http://www.aqmd.gov/news1/Archives/History/50th_photos.htm
Criteria pollutants reductions over time

- **PM (g/bhp-hr)**
  - 1990
  - 1991
  - 2004
  - 2010

- **NOx (g/bhp-hr)**
  - 1990
  - 1991
  - 2004
  - 2010

OBD
DETROIT DIESEL

DD13

DD15

DD16
DDC’s 1-Box BlueTec Aftertreatment System (ATS)

1-Box ATS installed on a truck

Clean-sheet design to optimize performance, fuel economy, and truck packaging

Control algorithms to optimize DPF regeneration and minimize aging impact
Government helping to offset adverse FE impact of criteria pollutants regulation
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Market forces drive efficiency

Variable costs (c/mi)
(not including insurance, taxes)

Wages, 55
Fuel, 78
Maintenance, 20
Tires, 3

Total fuel costs: effect of 0.1 mpg improvement

- For passenger cars:
  - Assume 30 mpg, 12,000 miles per year, $3 / gallon
  - 0.1 mpg $4 / year savings (~0.01% of per capita income)
- For an owner-operator:
  - Assume 6 mpg, 120,000 miles per year, $3 / gallon
  - 0.1 mpg $1,000 / year savings (~2% of income)
- For a fleet:
  - Steve Graham, director of fuel and tire systems for Schneider, said to Heavy Duty Trucking, April 2006, that 0.1 mile per gallon was worth $8 million / year to his company. (Fuel price in April 2006: ~$2.70, per DOE data.)

Sources:
- **Fuel (at $4.70 / gal and 6 mpg) = 78 c/mi** Re: Transport Topics, "Diesel and Gasoline Prices...," 2 June 2008, p. 1.
What manufacturers and fleets do to optimize FE

Technology optimization

- Many configurations based on application
  - *Note:* even many “SmartWay” fleets choose different HP, transmissions, rear axle ratios, fuel tanks, tires, hood/cab/sleeper models because of their unique applications, routes, etc.
- Speed limiting, logistical improvements, fuel efficiency rewards for drivers
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FE Regulations: Japanese Top Runner program

Powertrain info
- Vehicle factors (gear ratios, tire size, gear efficiency,...)
- Engine fuel consumption map

Running resistance info
- $C_dA$, RR preselected

Fuel flow model $\rightarrow$ FE (km/L)

Model-based program, validated by limited testing but does not recognize vehicular differences (e.g., $C_d$)
Smart vehicle regulations for the US

- What makes regulations smart?
  - Recognition of the differences between vehicles for different applications
  - Practicability
  - No adverse impacts on total fuel consumption

- What must be involved?
  - Starting with “big hitters” (linehaul, regional haul, P&D)
  - Using modeling and simulation, validated by limited testing
  - Rewarding “eco-innovations” not impacting test/model results
  - Comparing FE results only to similar vehicle applications
Funding for advanced engine, powertrain, and vehicle projects
Additional things the government can do to lessen fuel consumption

FE or CO₂ Rule

Engine

Vehicle

Operation (e.g., LCVs, idle reduction, driver training, ...)

Infrastructure (e.g., congestion mitigation, electrified parking, ...)

DOT, States, EPA SmartWay

Concept borrowed from Mr. Byron Bunker, EPA. Used with permission.
Conclusions

All three play role in reducing fuel consumption!