US Heavy Duty Vehicle Fleets Technologies for Reducing CO\textsubscript{2} An Industry Perspective

Excerpts from presentation to Transportation Research Board
January 14, 2008

Anthony Greszler
Vice President
Advanced Engineering

VOLVO POWERTRAIN CORPORATION
Heavy Duty Vehicle Fuel Efficiency is a Complex Issue

Many types of vehicles with different functions

How to Define & Measure Efficiency?
MPG is not an appropriate efficiency measure

Industry studies indicate 30-50% fuel savings by using triples instead of single trailers

- .5 Tons 96 cu-ft 22 MPG
- 30 Tons 4000 cu-ft 6.5 MPG
- 80 Tons 11000 cu-ft 3.5 MPG

All numbers are approximate
Freight movement energy efficiency is heavily influenced by congestion and vehicle size regulations.
Key Factors in HD Truck Efficiency

**Powertrain**

**Engine**
- Combustion/fuel injection
- Peak cylinder pressure
- Turbocharging
  - Increased Efficiency
  - Increased pressure ratio
- Friction and parasitic
- Exhaust aftertreatment
- Turbo compound
  - Mechanical
  - Electric
- Waste heat recovery

**Drivetrain**
- Transmission
  - Automated manual
- CVT
- Powershift
- Hybrid
  - Electric
    - Parallel
    - Series
  - Hydraulic

- Continuously improving
- New opportunity for optimization
- Coming Soon
Key Factors in HD Truck Efficiency

Vehicle

**Tractor**
- Aerodynamics
  - Frontal area
  - Side skirts
  - Roof fairings
  - Mirrors
  - Air blowing
- Rolling Resistance
  - Super single tires
  - Proper inflation
- Reduced Mass

**Trailer**
- Rolling resistance
  - Super Single tires
  - Rolling resistance
- Aerodynamics
  - Side skirts
  - Boat tail
- Weight

**Integration**
- Matching Powertrain to intended load/speed
- Trailer gap
- Accessories
  - Air compressor
  - Air conditioning
  - Cooling system
  - Power steering
- Idle management
  - APU
  - Truck stop electrification
  - Energy storage systems

Generally Deployed

Increasingly Deployed
Key Factors in HD Truck Efficiency
Regulation and Logistic

**Regulations and Public policy**
- Road Speed limiting
- Weight limits
- Trailer combinations
- Length limits
- Driver Hours of Service
- Congestion mitigation
- Incentives (hybrid)
- Education and support
  - EPA SmartWay program

**Logistics**
- Load management/backloads
- Route Optimization
  - Congestion Avoidance
  - Distance Minimization
- Vehicle management
  - Road speed limiting
  - Driver management
    - Smart gearing
    - Acceleration control
    - Idle management
  - Cruise management via GPS
    (anticipating grade and speed limit changes)

- State-to-state inconsistency is a major barrier to efficient freight movement.

- Significant gains have been realized in logistics. Still room for improvement.

Volvo Powertrain
Conclusions

• Commercial trucks have a defined mission to perform.
• Long Haul Trucks move freight.
• Narrowly defined tractor efficiency
  – Could box us into current vehicle configurations that won’t move freight most efficiently
  – Miss opportunities in logistics.
  – Won’t deal with trailers or matching trailers to tractors
  – Won’t meet needs of specialized applications
• We must look at mission efficiency, especially freight movement efficiency.