Freight Transportation Challenge
More Trucks, More Fuel, More GHGs?

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presented by
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Petroleum Fuel Consumption by U.S. Domestic Transportation Mode

Source: Policy Options for Reducing Energy Use and Greenhouse Gas Emissions from U.S. Transportation, Special Report 307, Transportation Research Board, Washington DC. 2011. Figure 1-1: Modal shares of U.S. transportation consumption of fuel use, 2005 to 2007 (Note: The total represents consumed gallons of gasoline, diesel, and jet fuel, irrespective of energy density. Mode totals were calculated through various government and industry sources for the most recent year in the period covered. Fuel used by pipelines, international aviation, and international maritime are excluded).
Elements of the Freight Transportation System

- Economic Structure
  *Type of Businesses, Number of Households*

- Industry Logistics Patterns
  *Supply Chains, Distribution Networks*

- Freight Infrastructure
  *Highways, Rail Lines, Ports, Airports...*

- Commodity/Vehicle Traffic Flows
  *Trucks, Planes, Rail Cars, Ships...*

- Organization and Public Policy
  *Ownership, Regulation, Pricing...*
Freight Demand

NAIC Industry Sectors

Agriculture, Forestry, Fishing and Hunting
- Crop Production
- Animal Production and Aquaculture
- Forestry and Logging
- Fishing, Hunting and Trapping
- Support Activities for Agriculture and Forestry

Mining, Quarrying, and Oil and Gas Extraction
- Oil and Gas Extraction
- Mining (except Oil and Gas)
- Support Activities for Mining

Utilities
- Utilities

Construction
- Construction of Buildings
- Heavy and Civil Engineering Construction
- Specialty Trade Contractors

Manufacturing
- Food Manufacturing
- Beverage and Tobacco Product Manufacturing
- Textile Mills
- Textile Product Mills
- Apparel Manufacturing
- Leather and Allied Product Manufacturing
- Wood Product Manufacturing
- Paper Manufacturing
- Printing and Related Support Activities
- Petroleum and Coal Products Manufacturing
- Chemical Manufacturing
- Plastics and Rubber Products Manufacturing
- Nonmetallic Mineral Product Manufacturing
- Primary Metal Manufacturing
- Fabricated Metal Product Manufacturing
- Machinery Manufacturing
- Computer and Electronic Product Manufacturing
- Electrical Equipment, Appliance, and Component Manufacturing
- Transportation Equipment Manufacturing
- Furniture and Related Product Manufacturing
- Miscellaneous Manufacturing

Wholesale Trade
- Merchant Wholesalers, Durable Goods
- Merchant Wholesalers, Nondurable Goods
- Wholesale Electronic Markets and Agents and Brokers

Retail Trade
- Motor Vehicle and Parts Dealers
- Furniture and Home Furnishings Stores
- Electronics and Appliance Stores
- Building Material and Garden Equipment and Supplies Dealers
- Food and Beverage Stores
- Health and Personal Care Stores
- Gasoline Stations
- Clothing and Clothing Accessories Stores
- Sporting Goods, Hobby, Musical Instrument, and Book Stores
- General Merchandise Stores
- Miscellaneous Store Retailers
- Non-store Retailers

National Security and International Affairs

Transportation and Warehousing
- Air Transportation
- Rail Transportation
- Water Transportation
- Truck Transportation
- Transit and Ground Passenger Transportation
- Pipeline Transportation
- Scenic and Sightseeing Transportation
- Support Activities for Transportation
- Postal Service
- Couriers and Messengers
- Warehousing and Storage

Information
- Publishing Industries (except Internet)
- Motion Picture and Sound Recording Industries
- Broadcasting (except Internet)
- Telecommunications
- Data Processing, Hosting, and Related Services
- Other Information Services

Finance and Insurance
- Monetary Authorities-Central Bank
- Credit Intermediation and Related Activities
- Securities, Commodity Contracts, and Other Financial Investments and Related Activities
- Insurance Carriers and Related Activities
- Funds, Trusts, and Other Financial Vehicles
- Real Estate and Rental and Leasing

Real Estate
- Rental and Leasing Services
- Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)

Professional, Scientific, and Technical Services
- Professional, Scientific, and Technical Services
- Management of Companies and Enterprises
- Management of Companies and Enterprises

Administrative and Support and Waste Management and Remediation Services
- Administrative and Support Services
- Waste Management and Remediation Services

Educational Services
- Educational Services

Health Care and Social Assistance
- Ambulatory Health Care Services
- Hospitals
- Nursing and Residential Care Facilities
- Social Assistance

Arts, Entertainment, and Recreation
- Performing Arts, Spectator Sports, and Related Industries
- Museums, Historical Sites, and Similar Institutions
- Amusement, Gambling, and Recreation Industries

Accommodation and Food Service
- Accommodations
- Food Services and Drinking Places

Other Services (except Public Administration)
- Repair and Maintenance
- Personal and Laundry Services
- Religious, Grantmaking, Civic, Professional, and Similar Organizations
- Private Households

Public Administration
Example of Logistics Supply Chain for House Paint and Detergents

Legend
- Cargo Flow
- Bulk Petroleum Tanker from Middle East
- Bulk Petroleum Off-Shore Platform
- Crude Oil: Houston, TX
- Bulk Product: Cincinnati, OH
- Detergent: Chicago, IL
- Refined Product: Knoxville, TN
- Industrial Chemical: New York, NY

Highway Movement (tons)
- 1 - 20 Million
- 20 - 40 Million
- 40 - 60 Million
- 60 - 80 Million
- More than 80 Million

Rail Movement (tons)
- 1 - 20 Million
- 20 - 40 Million
- 40 - 60 Million
- 60 - 80 Million
- More than 80 Million

Water Movement (tons)
- 1 - 20 Million
- 20 - 40 Million
- 40 - 60 Million
- 60 - 80 Million
- More than 80 Million

Freight Transportation Systems

- Sail
- Rail
- Truck
- Air

Information
- Digital communications
- Onboard computers
- GPS
- RFID
- ...
From Push to Pull Logistics Systems

“PUSH” METHODS OF CONTROL (relative importance)

“PULL” METHODS OF CONTROL (relative importance)
Warehousing Employment

Source: Cambridge Systematics, Inc., based on U.S. Census, County Business Patterns, 2005
Freight Truck Trips Between 100 and 500 Miles

Megaregion Freightsheds

Source: Cambridge Systematics, Inc., based on Global Insight, Inc., 2004 TRANSEARCH data.
National Freight Truck and Freight Rail Flows

Source: Cambridge Systematics, Inc., based on IHS-Global Insight, Inc., TRANSEARCH data.
Highway Truck Bottlenecks

Truck and Rail Mode Shares by Tonnage, 2008

Source: Cambridge Systematics, Inc., based on IHS-Global Insight, Inc., TRANSEARCH data.
## Truck Freight Tons, Vehicle-Miles of Travel, and Ton-Miles, 2010 and 2030

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>Percent</th>
<th>2030</th>
<th>Percent</th>
<th>Annual Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tons (billions)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Metropolitan hauls</td>
<td>4.7</td>
<td>36%</td>
<td>6.9</td>
<td>35%</td>
<td>1.9%</td>
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<tr>
<td>Intrastate hauls</td>
<td>5.5</td>
<td>42%</td>
<td>7.9</td>
<td>40%</td>
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<tr>
<td>Interstate hauls</td>
<td>3.0</td>
<td>22%</td>
<td>5.0</td>
<td>25%</td>
<td>2.6%</td>
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<tr>
<td>Total</td>
<td>13.2</td>
<td>100%</td>
<td>19.7</td>
<td>100%</td>
<td>2.0%</td>
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<tr>
<td><strong>Vehicle-Miles of Travel (billions)</strong></td>
<td>2010</td>
<td>Percent</td>
<td>2030</td>
<td>Percent</td>
<td>Annual Growth Rate</td>
</tr>
<tr>
<td>Metropolitan hauls</td>
<td>39.3</td>
<td>17%</td>
<td>57.2</td>
<td>16%</td>
<td>1.9%</td>
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<td>Intrastate hauls</td>
<td>92.1</td>
<td>39%</td>
<td>131.5</td>
<td>36%</td>
<td>1.8%</td>
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<td>Interstate hauls</td>
<td>105.7</td>
<td>45%</td>
<td>177.2</td>
<td>48%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Total</td>
<td>237.1</td>
<td>100%</td>
<td>365.9</td>
<td>100%</td>
<td>2.2%</td>
</tr>
<tr>
<td><strong>Ton-Miles (billions)</strong></td>
<td>2010</td>
<td>Percent</td>
<td>2030</td>
<td>Percent</td>
<td>Annual Growth Rate</td>
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<tr>
<td>Metropolitan hauls</td>
<td>118</td>
<td>5%</td>
<td>172</td>
<td>5%</td>
<td>1.9%</td>
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<td>Intrastate hauls</td>
<td>553</td>
<td>26%</td>
<td>789</td>
<td>23%</td>
<td>1.8%</td>
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<td>Interstate hauls</td>
<td>1,480</td>
<td>69%</td>
<td>2,480</td>
<td>72%</td>
<td>2.6%</td>
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<tr>
<td>Total</td>
<td>2,151</td>
<td>100%</td>
<td>3,441</td>
<td>100%</td>
<td>2.4%</td>
</tr>
</tbody>
</table>

Projected Miles per Gallon for Freight Trucks, 2010 and 2030

Projected Diesel Fuel Consumption by Freight Trucks, 2010 and 2030

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**Economic Structure**
- Type of Businesses, Number of Households

**Industry Logistics Patterns**
- Supply Chains, Distribution Networks

**Freight Infrastructure**
- Highways, Rail Lines, Ports, Airports...

**Commodity/Vehicle Traffic Flows**
- Trucks, Planes, Rail Cars, Ships...

**Organization and Public Policy**
- Ownership, Regulation, Pricing...

- Increase near-sourcing and in-sourcing
- Change commodity demand through substitution of goods, additive manufacturing, etc.

- Shift longer-haul freight from road to rail
- Relocate distribution centers closer to markets

- Reduce bottlenecks and congestion
- Add/relocate freight networks
- Introduce VMT fees for LDVs

- Optimize routing and dispatching
- Improve engine/powertrain efficiencies
- Increase and optimize cargo capacity
- Introduce cleaner fuels