Clean Energy®

North America's leader in clean transportation

Making America's Fuel – Natural Gas Work in the Marketplace

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VP Technology Advancement
Clean Energy
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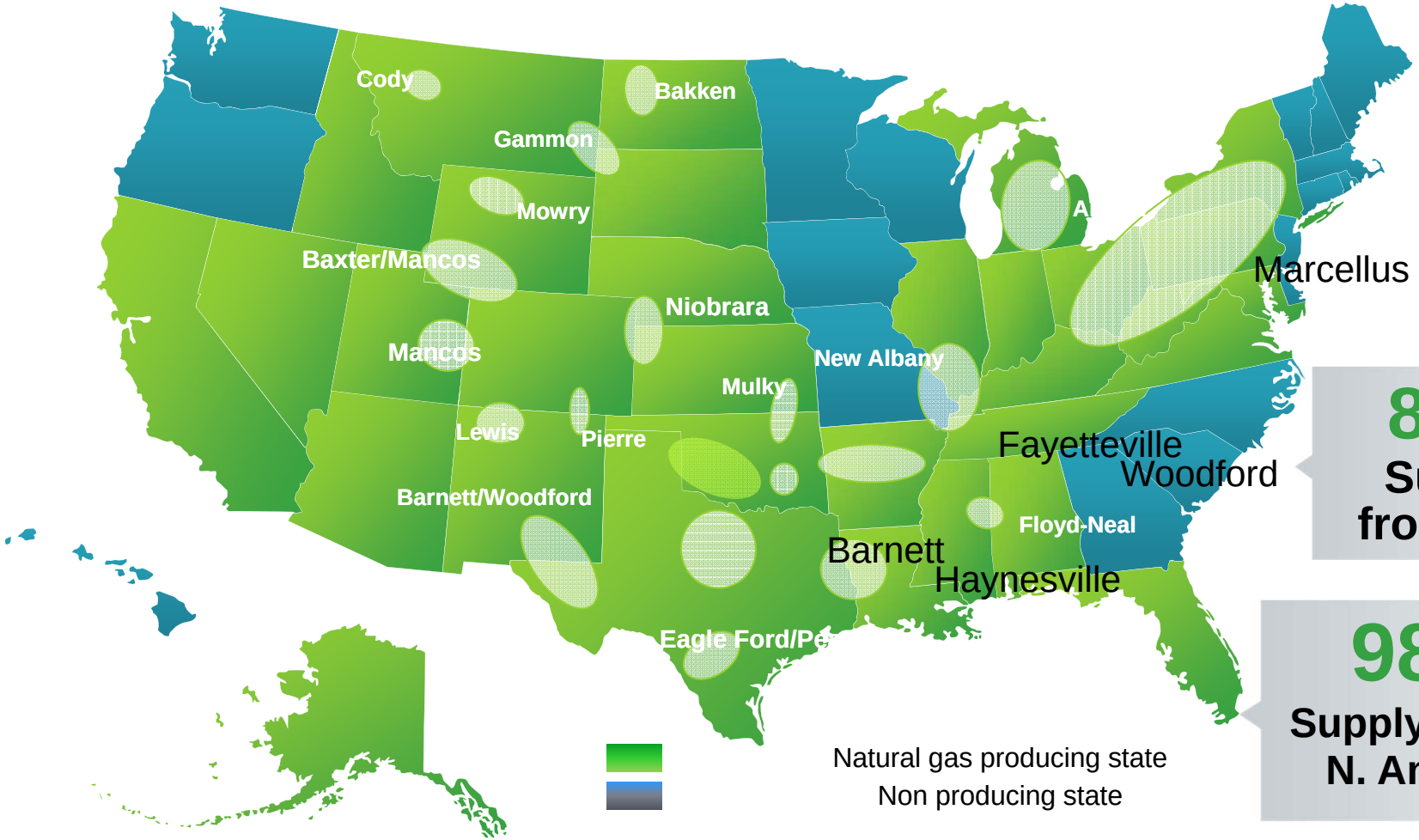
150+ Year Supply and Growing

32 of 50 States Produce Natural Gas

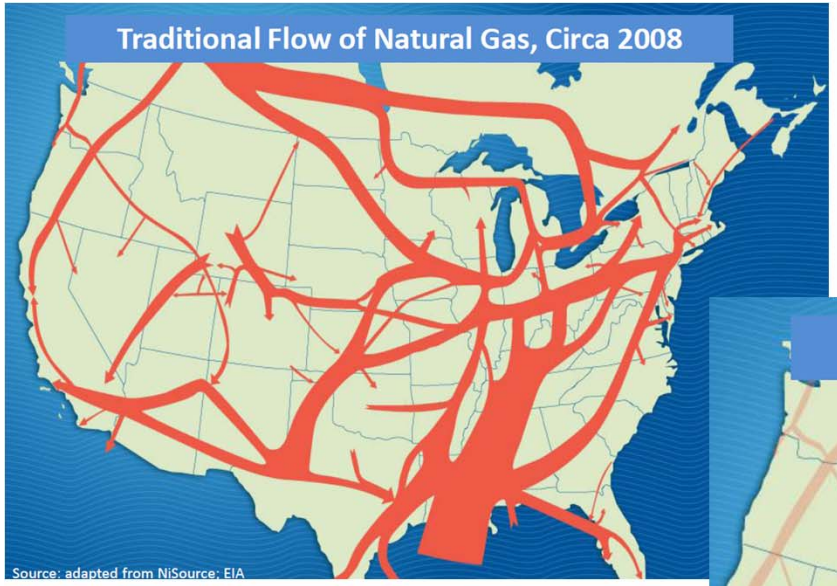


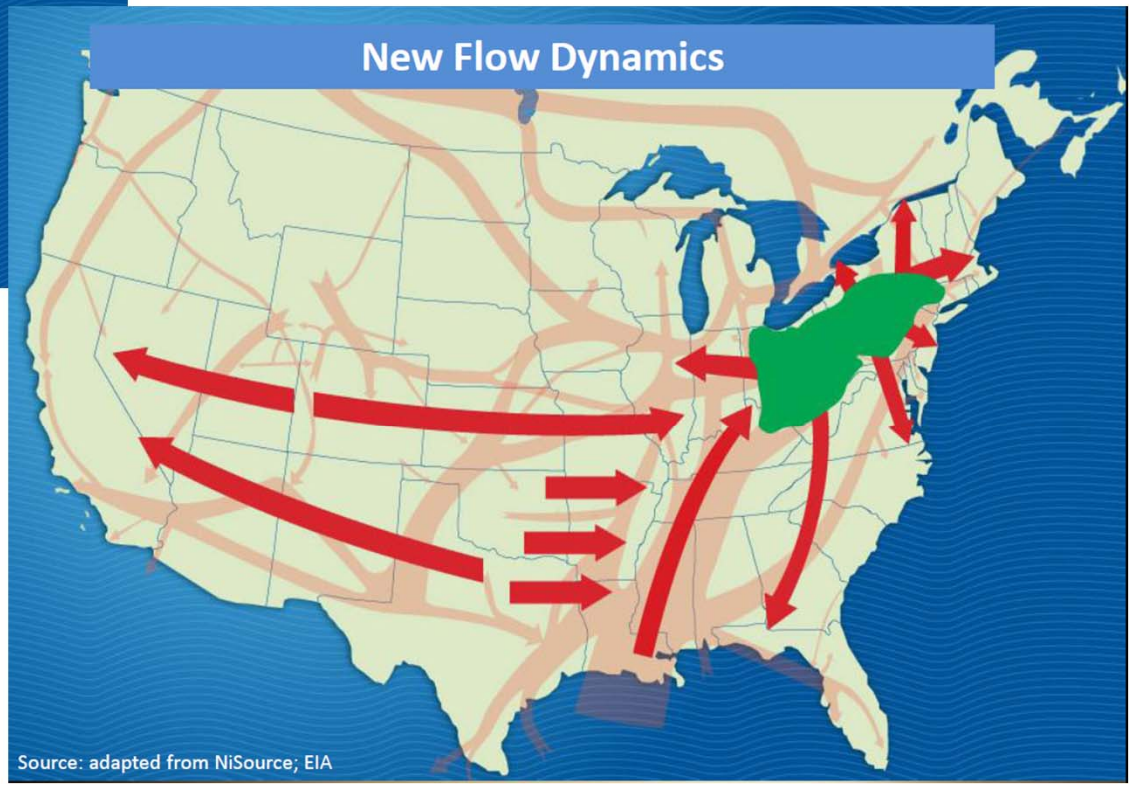
85%
Supply from U.S.

98%
Supply is from N. America

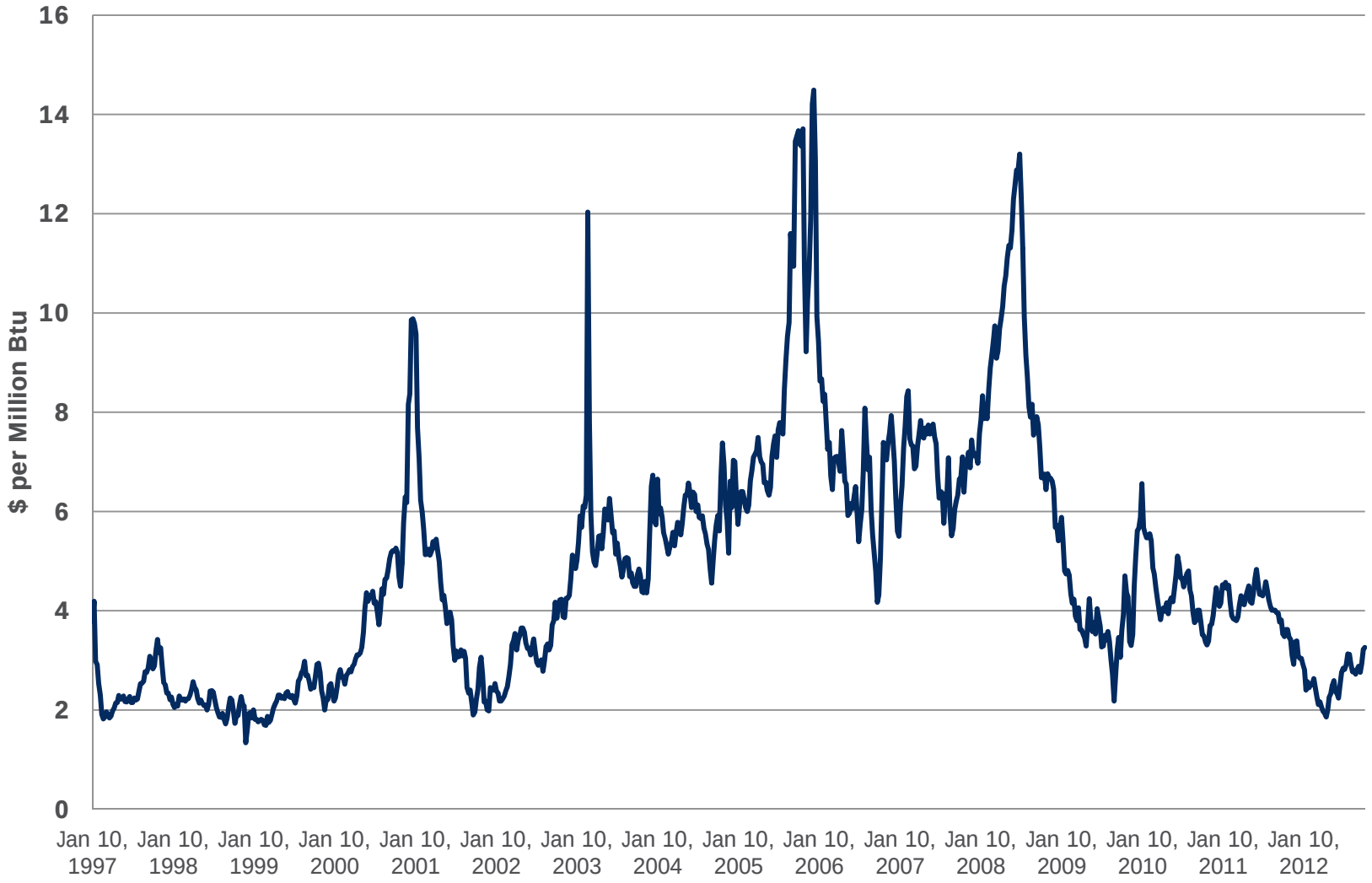
U.S. natural gas deposits are far more widespread and larger than U.S. coal deposits

Reversing the Tide





Henry Hub Prices for Natural Gas (1997-2012)



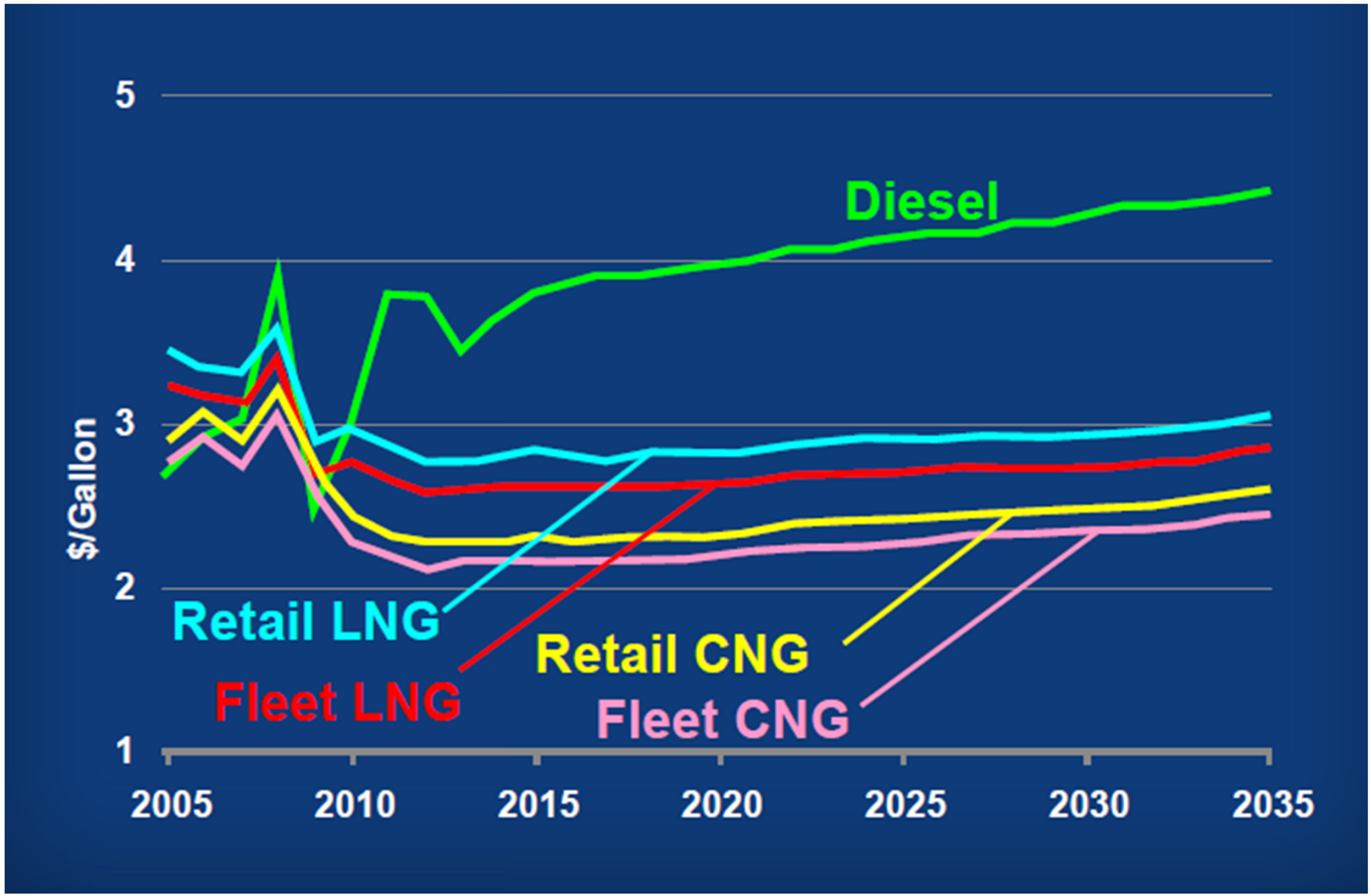
Abundant, Cheap, Clean, & Domestic Natural Gas – Where do you use it?

- Traditional gas markets (res., com., industrial)
- Substitution for coal and expansion of power generation
- Increased use in chemicals/feedstocks
- Exports
- Transportation
- ***All of the above***

Natural Gas for Transportation – Can it be done?

- World natural gas vehicles (NGVs) total 16.5 million
  - Mostly bi-fuel light duty vehicles
  - Market penetration is 2.9 million in Iran and 3.1 million in Pakistan
- U.S. approach has been to focus on high fuel use fleet vehicles
  - Transit buses (up to 15,000 gal/veh/yr)
  - Refuse trucks (up to 10,000 gal/veh/yr)
  - Taxis/Shuttles (up to 7,500 gal/veh/yr)
- High differential cost of vehicles justified by fuel savings
- Major focus on return to base fleets to minimize infrastructure
- For nearly 20 years – major benefit of NGVs has been Air Quality not economics

Fuel Economics



National Petroleum Council Study (Aug 2012)

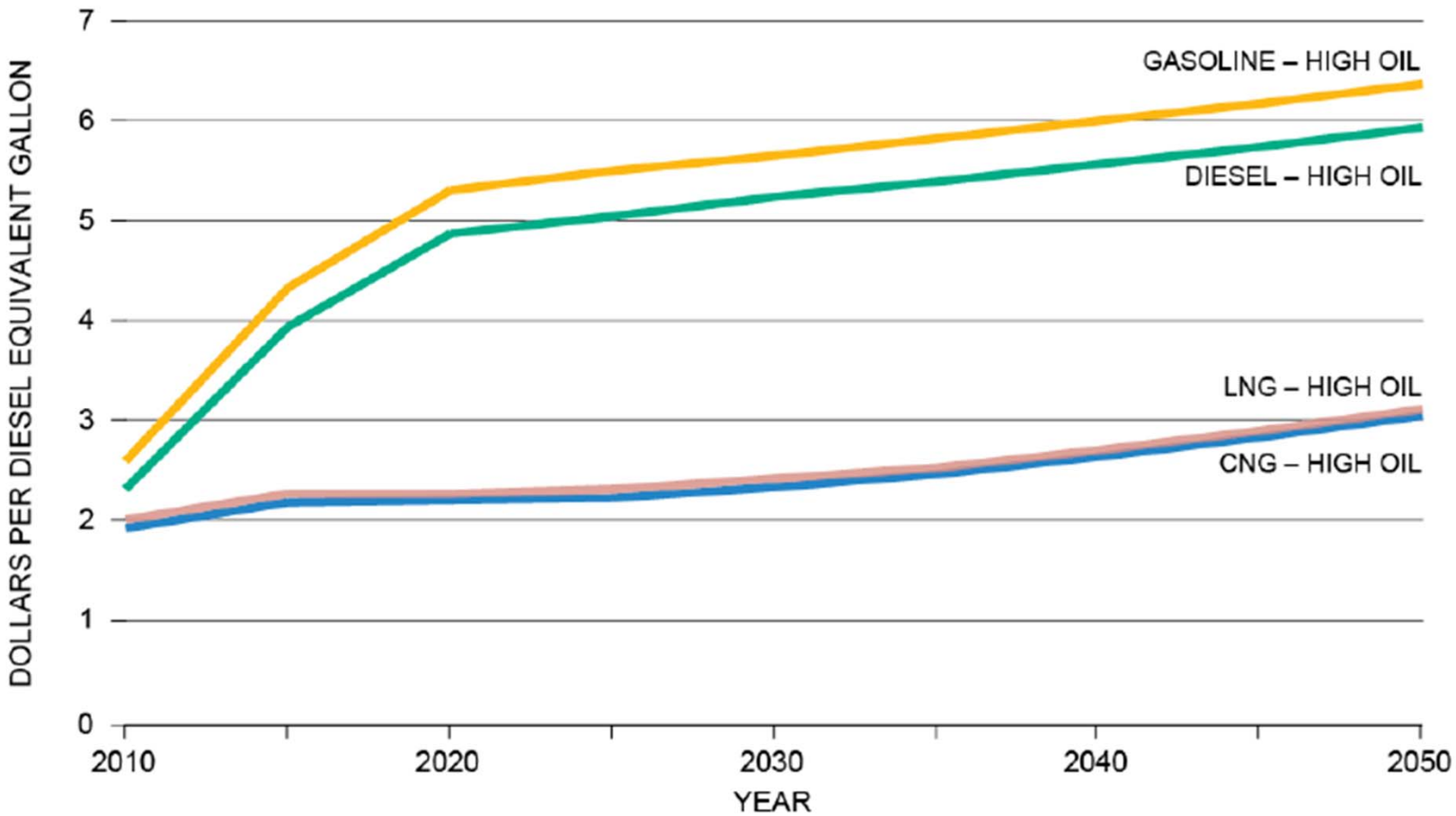
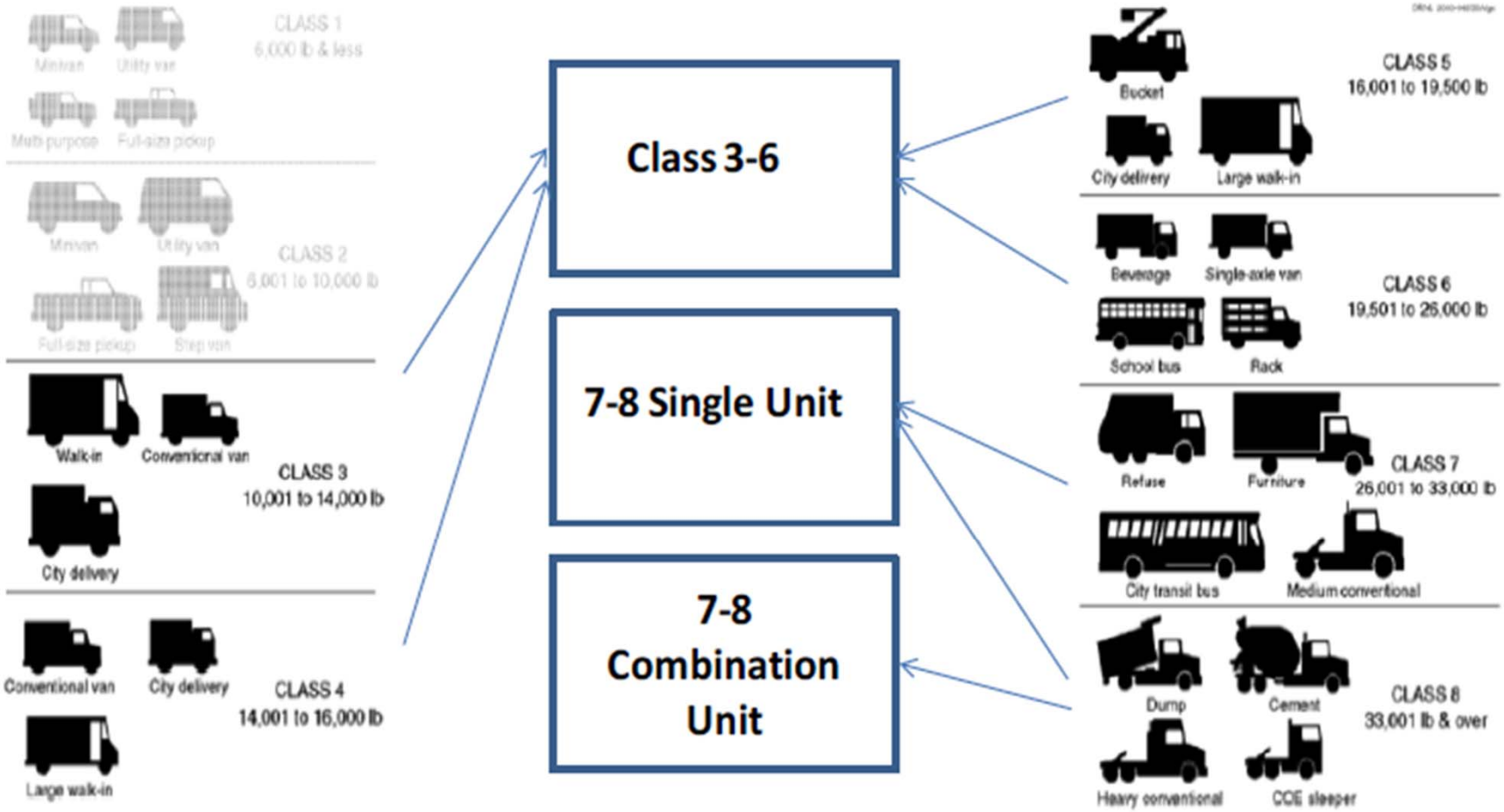


Figure 3-8. Dispensed Fuel Price Assumptions – High Oil Price Case

Where will the Market Grow?



Expansion of Natural Gas Infrastructure for Transportation

- NGV market will continue to grow in urban markets with fleet vehicles
- More than 40 companies competing to build infrastructure for urban NGV business
- But where is the largest single market opportunity to displace conventional gasoline or diesel fuel
- **Class 8 truck market**
  - LNG and CNG
  - LNG for long haul applications

Fuel Consumption by Type of Vehicle

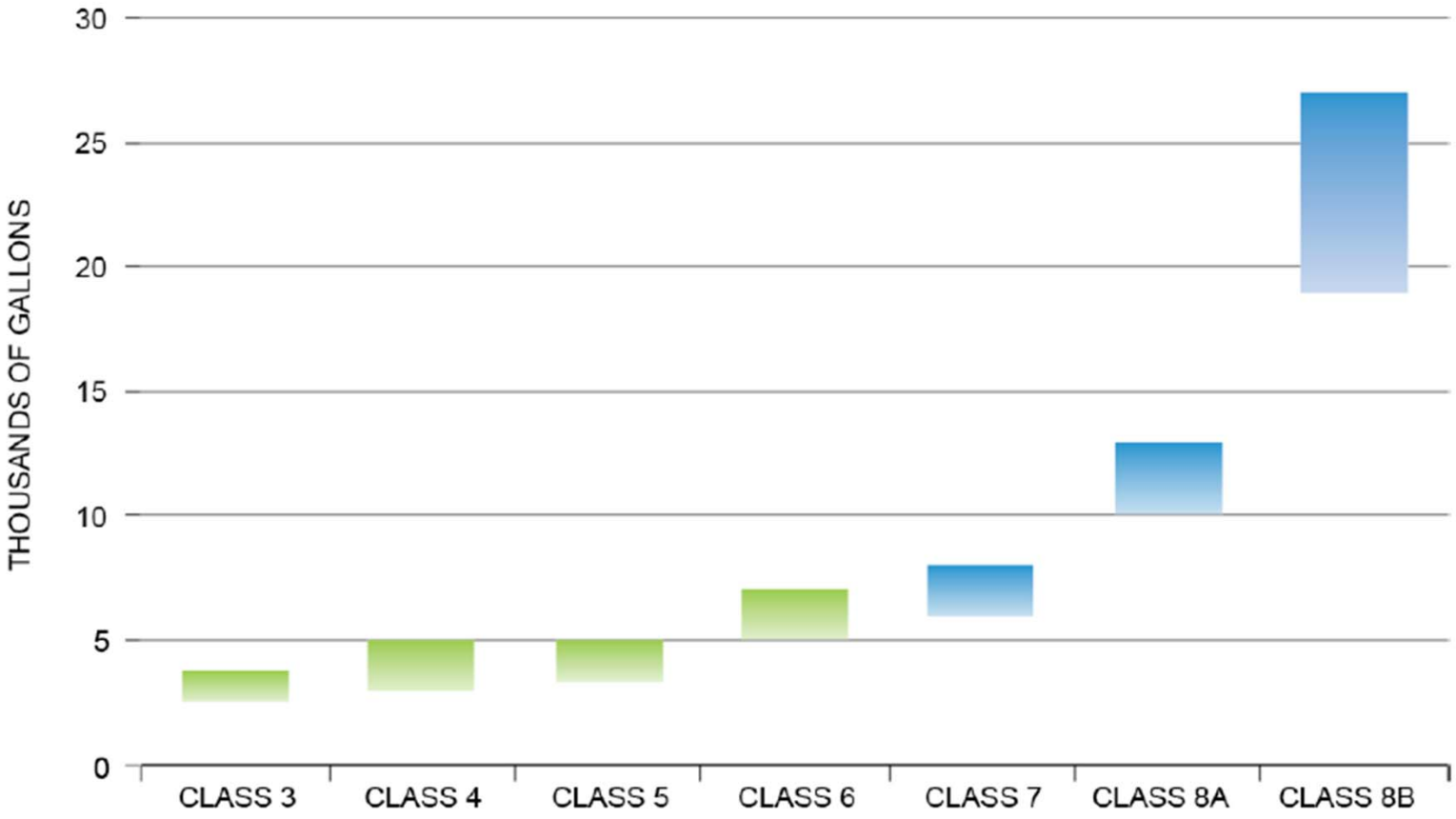
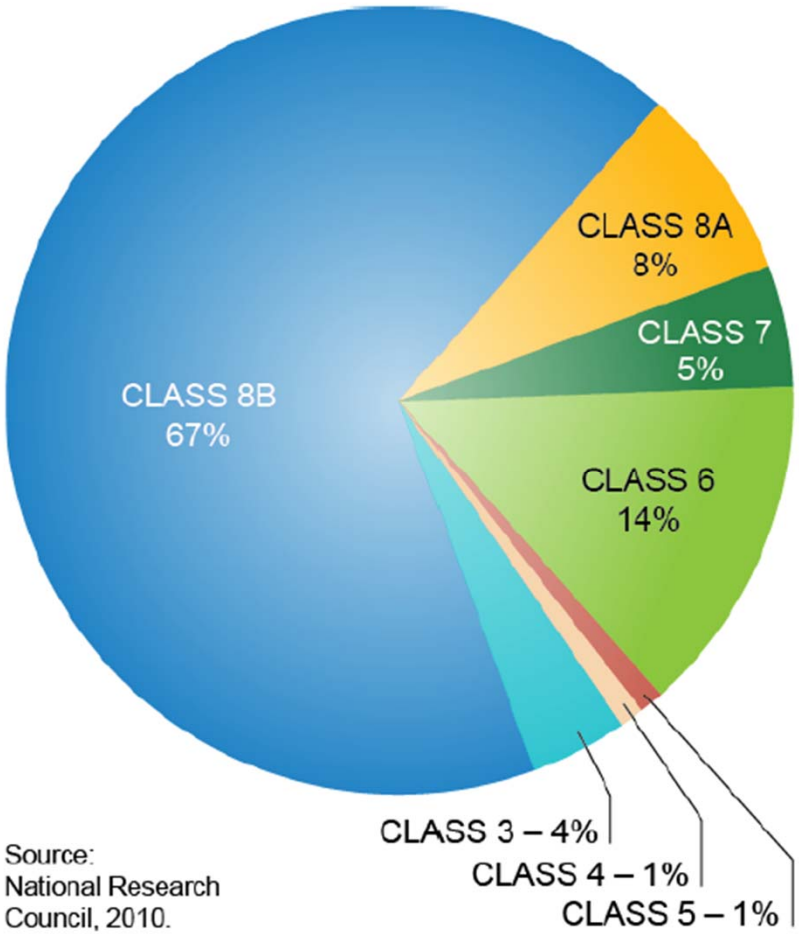


Figure NG 19. Typical Annual Fuel Consumption in Heavy-Duty Trucks

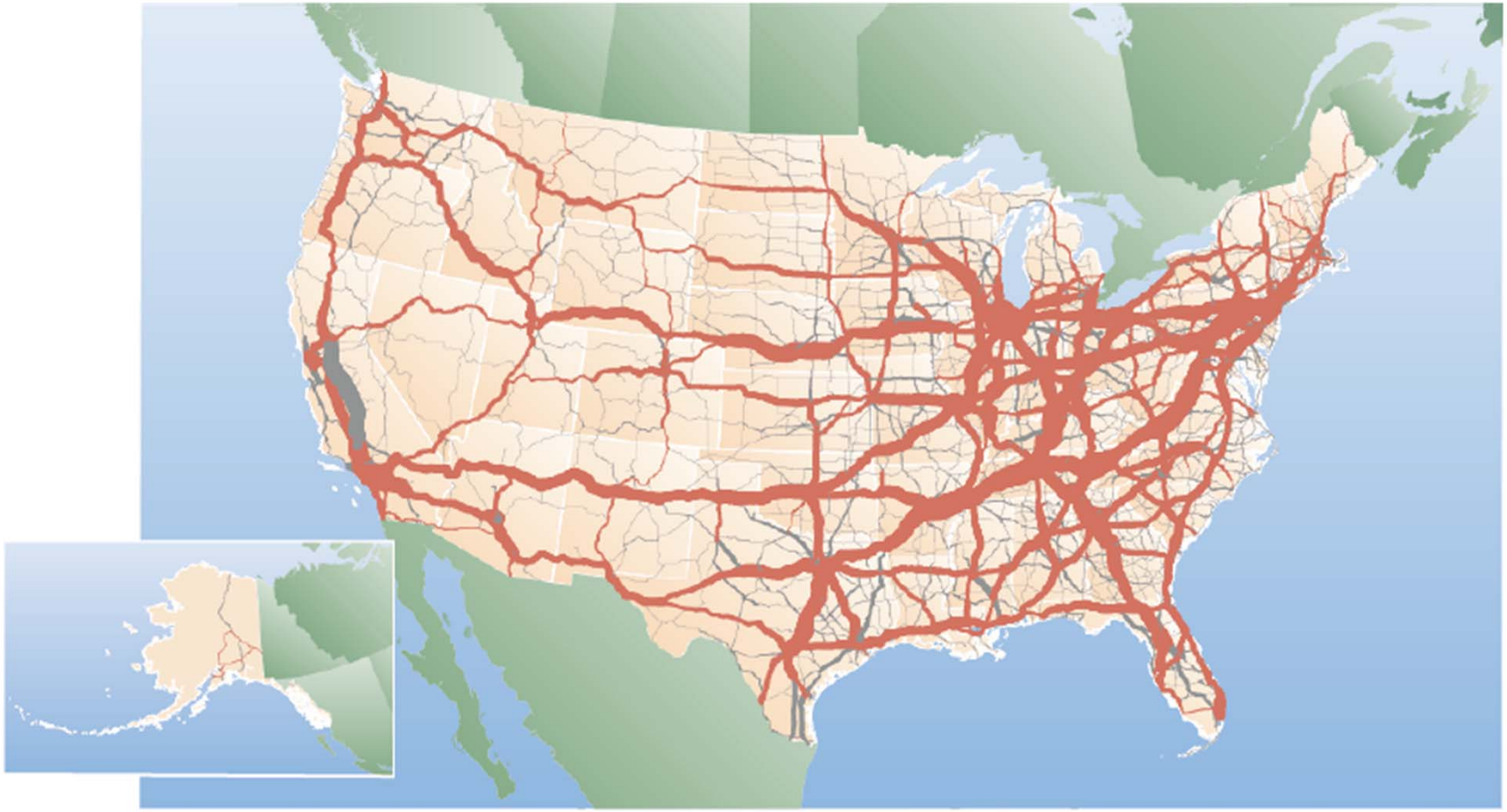
How big is Over-the-Road Trucking?



Source:
National Research Council, 2010.

- 40 billion gal/yr diesel consumption
- 23-25 billion gal/yr for line haul Class 8 trucks
- Equivalent to 3.3 TCF/yr natural gas market
- About 14% of current U.S. gas consumption if 100% conversion of Class 8 over the road trucks

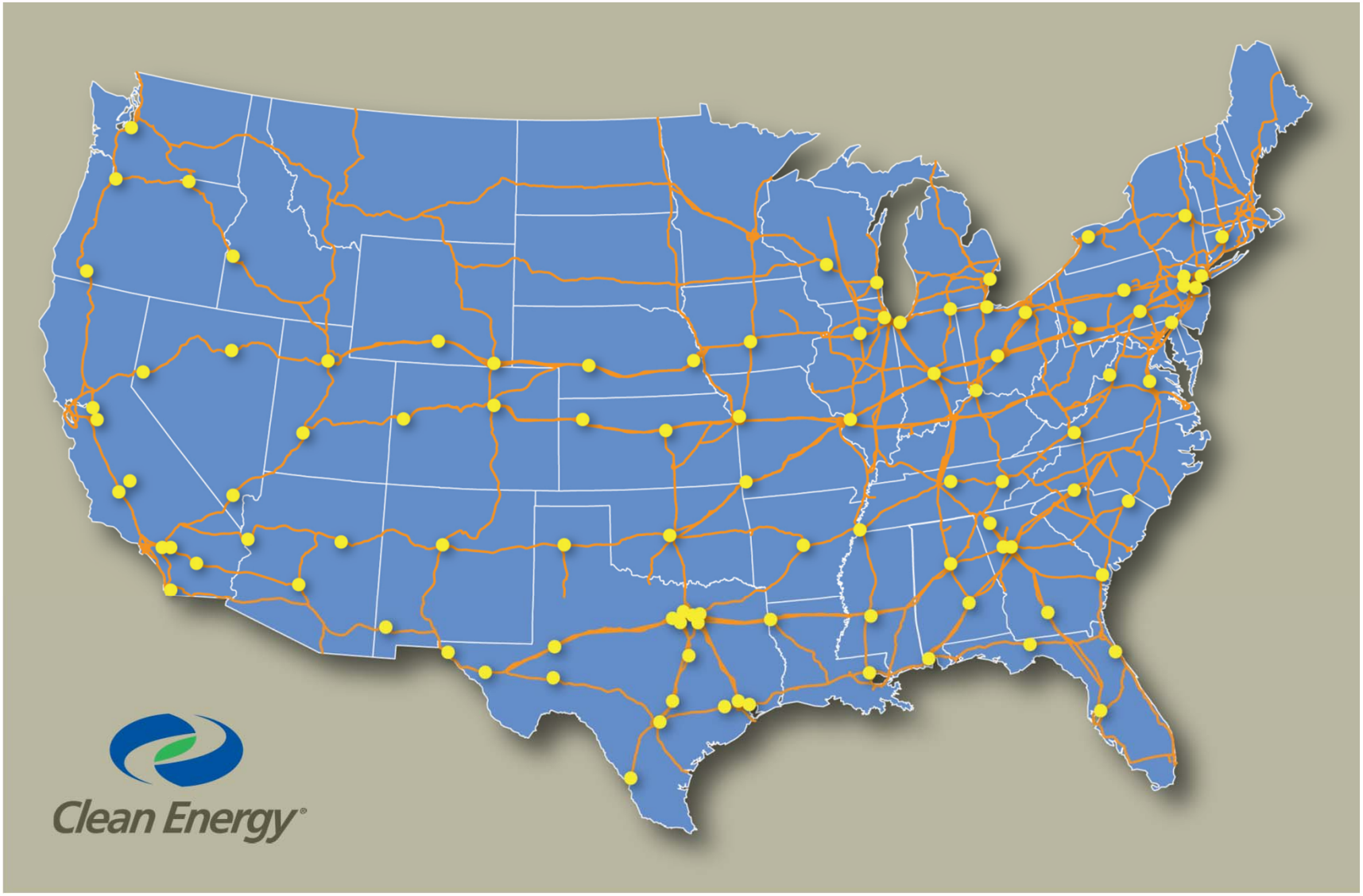
Goods Movement – Ton Miles



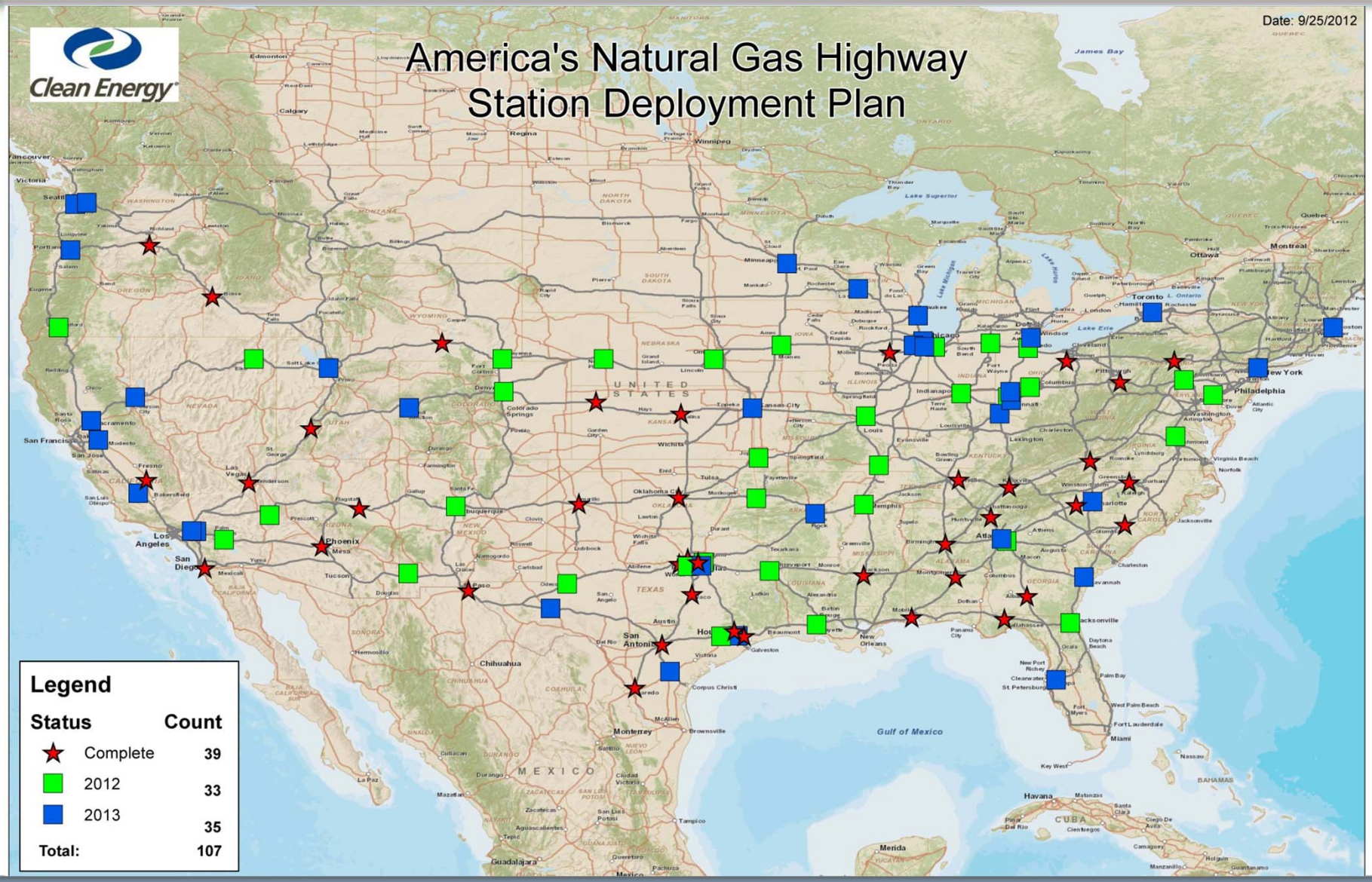
Source: The Federal Highway Administration: 2009 Facts and Figures

America's Natural Gas Highway (ANGH)

Coast-to-Coast & Border-to-Border on LNG



ANGH Station Rollout



Completed ANGH Stations

Hope Hull, AL

Latta, SC

Oklahoma City, OK

Pearl, MS

An Operational ANGH Network

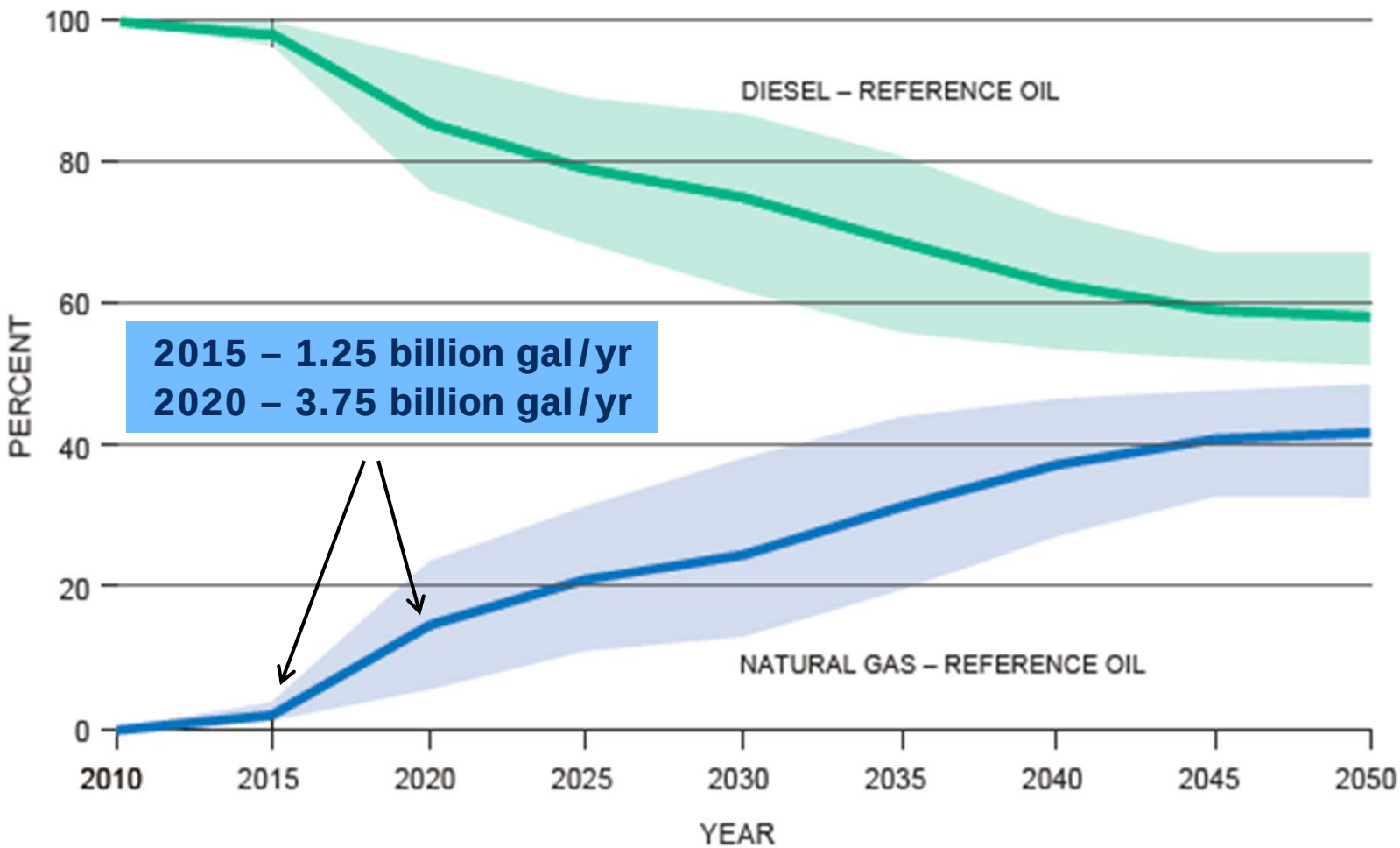
LNG Production Plants
Boron, California & Willis, Texas

Natural Gas Truck Market Penetration

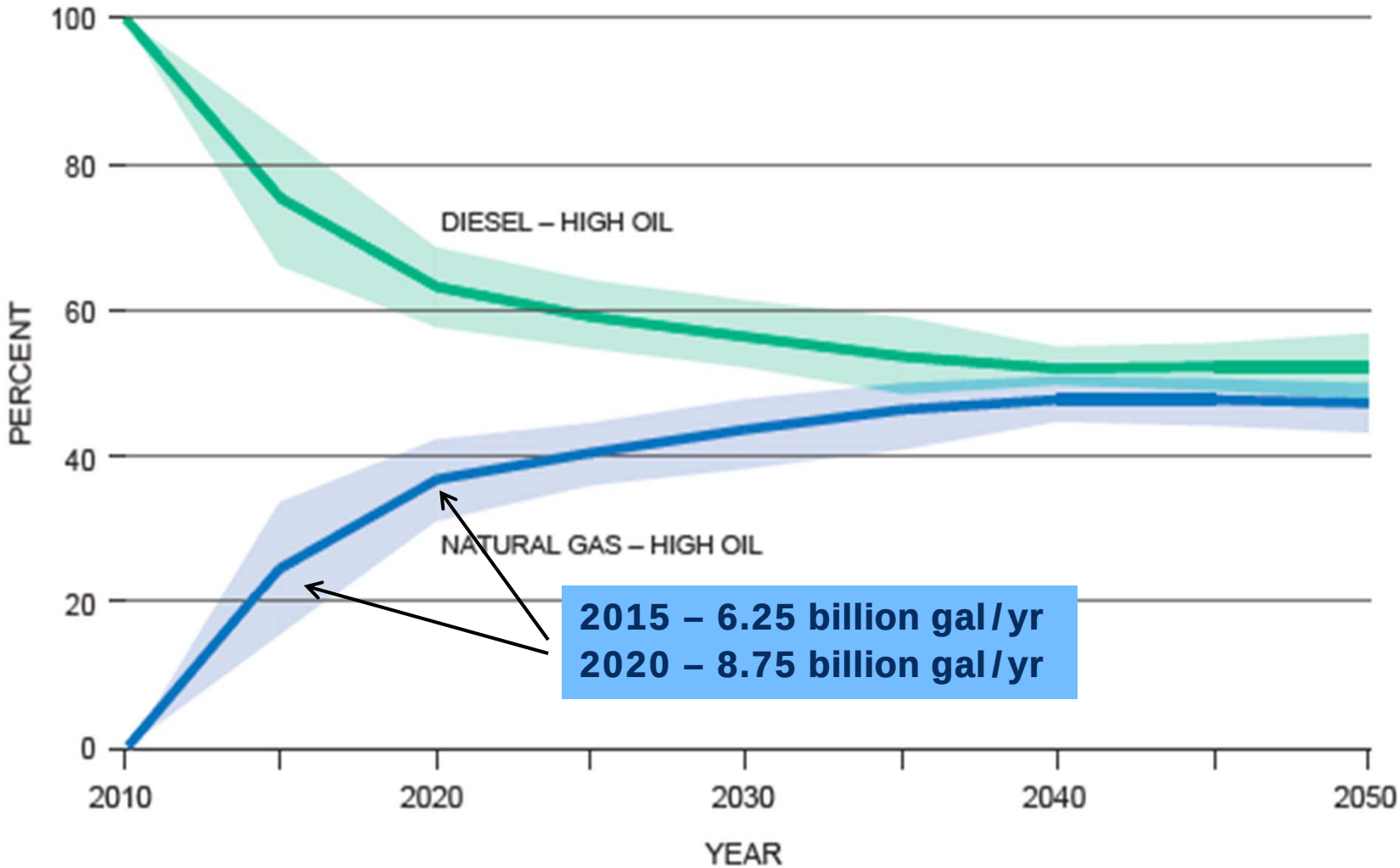
- National Fleets are deploying natural gas trucks
  - Cost savings & Sustainability initiatives

Fleet Additions:
Anheuser Busch
Bridgestone
Coca Cola
C.R. England
Dillon Transport
Dean Foods
Fresh & Easy
Giant Eagle
Linde
PAM Transport
Paper Transport
Praxair
Premier Transportation
Ruan Transportation
Saddle Creek Corporation
Staples
Swift Transportation
UNFI

Class 7 & 8 Market Shares of New Diesel and Natural Gas Trucks: Reference Oil Case (NPC)



Class 7 & 8 Market Shares of New Diesel and Natural Gas Trucks: High Oil Case (NPC)



NPC Study Conclusions (August 2012)

"Fuel economy can be dramatically improved in the light- and heavy-duty sectors through the advancement and application of existing and new technology. Internal combustion engine technologies are likely to be the dominant propulsion systems for decades to come, <u>with liquid fuel blends continuing to play a significant, but reduced role</u>."

Collateral Natural Gas Markets

- Railroads
  - Responding to competitive threat of lower cost trucking
- Off-road vehicles
- Mining
- Marine
- Consumer market
  - May be the last market to develop
  - Requires tremendous infrastructure (140,000 retail gasoline outlets)
  - Expansion of MD and HD markets will expand infrastructure to the point that OEMs will respond

Thank You!

Clean Energy

Largest Natural Gas Fuel Provider in North America

330+	660+	25,000+	200 Million
Natural Gas Fueling Stations	Fleet Customers	Natural Gas Vehicles	Gallons Natural Gas

Compressed Natural Gas (CNG)

Taxis

Transit Buses

Airport Vehicles

Regional Trucking

Liquefied Natural Gas (LNG)

Port Trucking

LNG Tanker Trailer

LNG Station

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