



Sustainable Mobility

*Energy Efficiency and
Advanced Technology Pathways*

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Overview

- Sustainable Mobility:
Our Vision for the Future
- Auto Industry Progress to Date:
Improvements in Product Efficiency
- Key Challenges Moving Forward
- Pathway for the Future:
Advanced Technology Vehicles
- An Alternative Pathway For Today:
Ethanol (E85) Flexible Fuel Vehicles
- The Role of Stakeholders:
An Integrated Approach





Sustainable Mobility

“Improved sustainable performance is not just a requirement, but a tremendous business opportunity.”

- *Bill Ford*

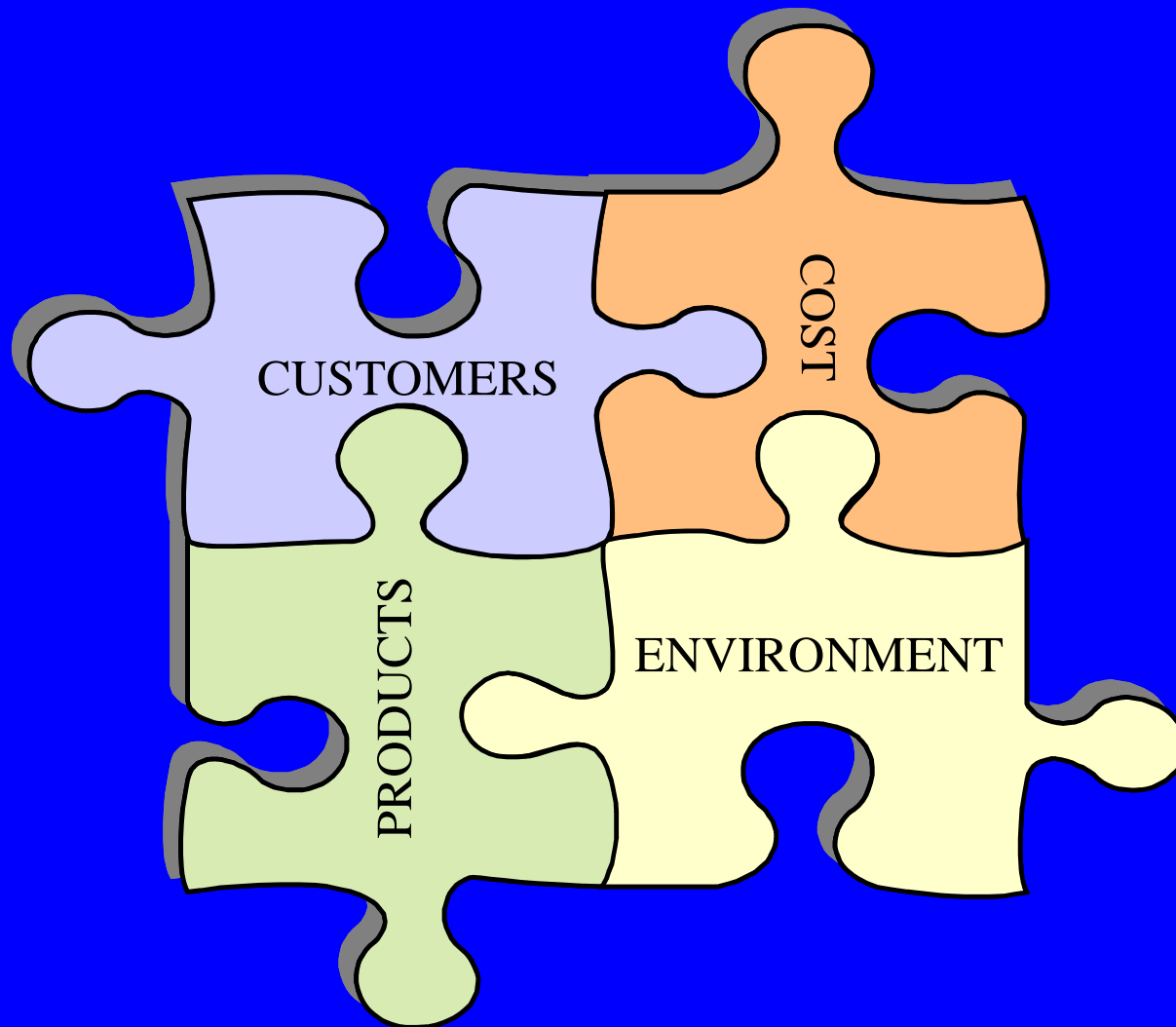


Our vision for the 21st century is to provide SUSTAINABLE transportation that is affordable in every sense of the word:

Socially, Environmentally, & Economically



Maintaining a Critical Balance





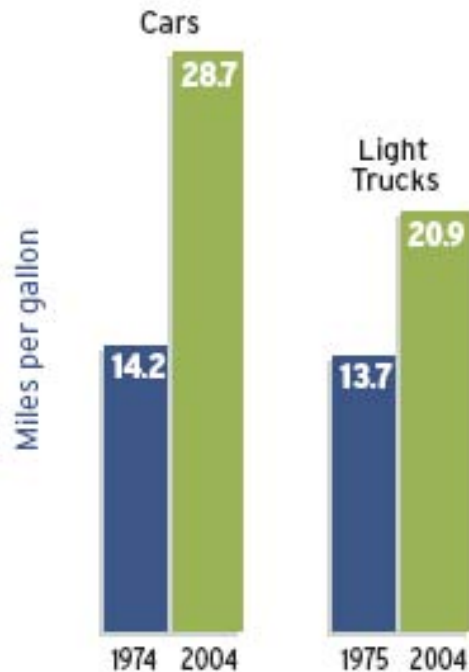
Global Market Drivers



Different needs drive different solutions. No Single Solution Fits All.

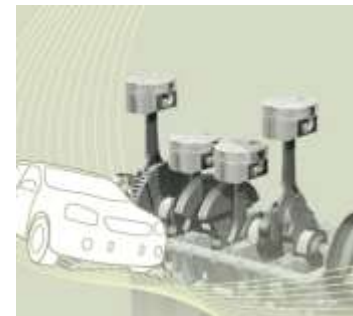


Auto Industry Progress to Date: Fuel Economy has Increased



- Average fuel economy levels in the mid-1970s
- Average fuel economy levels in 2004

- Fuel economy rates in cars increased more than 100 percent since 1974.
- Fuel economy rates in trucks (minivans, vans, SUVs, and pickups) increased 53 percent since 1975.
- Today's average light truck gets better mileage than an average 1970s compact car.
- The average 2004 SUV gets 33 percent better mileage than the average car in 1975.





Ford's Family of Brands:

13 Models at 30 mpg* or Better!



Mazda 3 Sedan
35 mpg



Ford Focus Sedan
37 mpg



Ford Focus Wagon
37 mpg



Ford Fusion
31 mpg



Mercury Milan
31 mpg



Volvo S40
31 mpg



Volvo V50
31 mpg



Mazda 6 Sedan
32 mpg



Ford Escape Hybrid (08)
30 mpg (34 mpg city)



Volvo S60
30 mpg



Mazda MX-5
30 mpg



Mazda Tribute Hybrid (08)
30 mpg (34 mpg city)



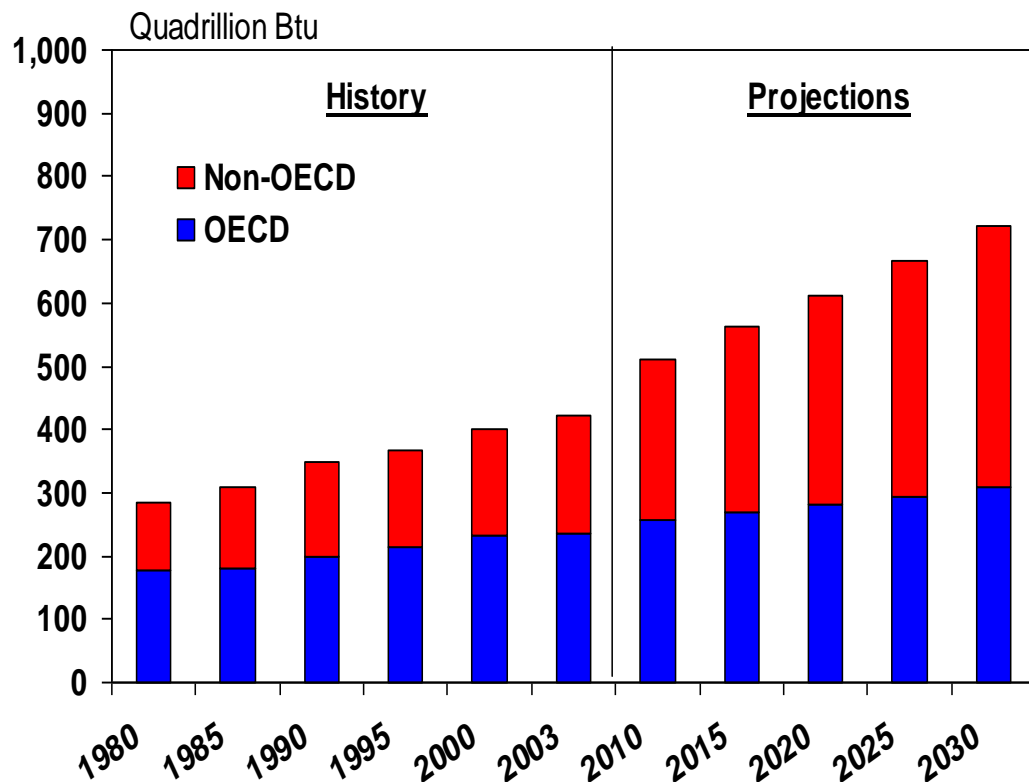
Mercury Mariner Hybrid (08)
30 mpg (34 mpg city)

* Source: 2007 MY EPA/DOE Fuel Economy Guide – Highway Estimates



Key Challenges: Energy Demand

World Marketed Energy Consumption



- World energy consumption is projected to increase 71% from 2003 to 2030
- Most rapid growth in demand from 2003-2030 is for Non-OECD nations including China and India
- Increases result from projected regional economic growth

Sources: History: Energy Information Administration (EIA), International Energy Annual 2003 (May – July 2005), Projections: EIA, System for the Analysis of Global Energy Markets (2006) – Organization for Economic Cooperation & Development.



Key Challenges: Energy Security

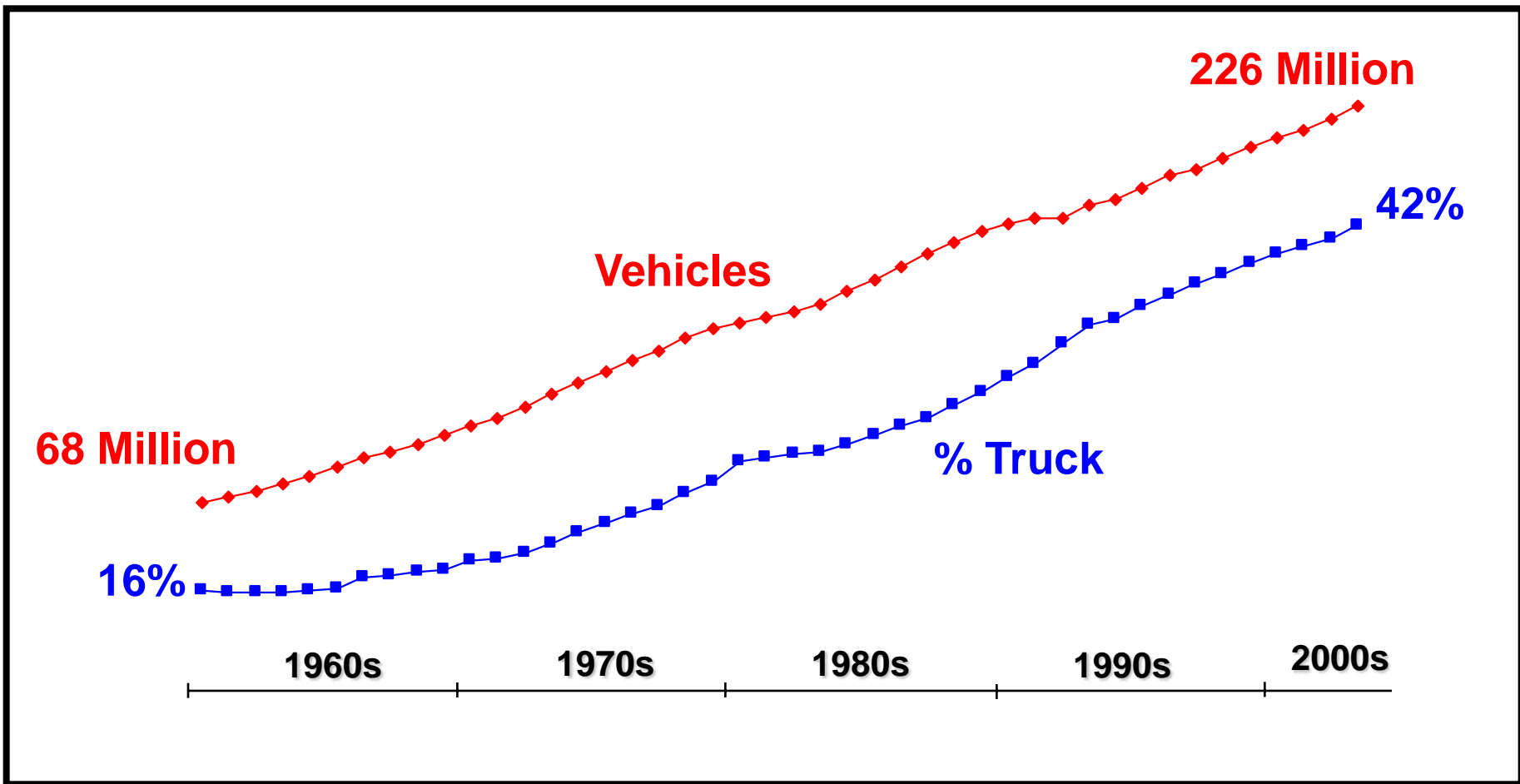
- More than 60% of U.S. oil is imported from foreign sources



- Current volatility in gasoline fuel prices is expected to continue

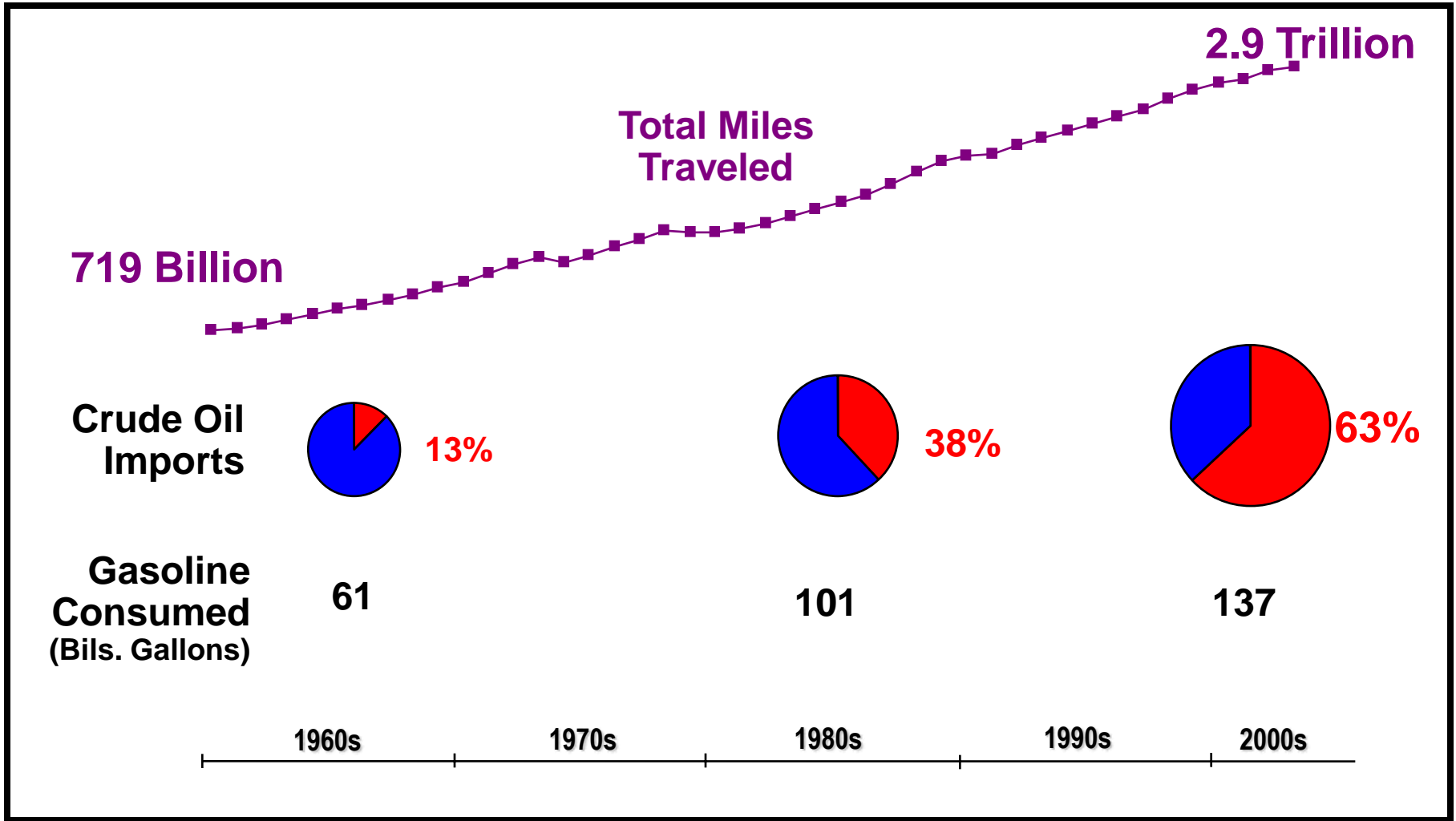


Overall Fleet Fuel Consumption: Influenced by Vehicle Population & Mix



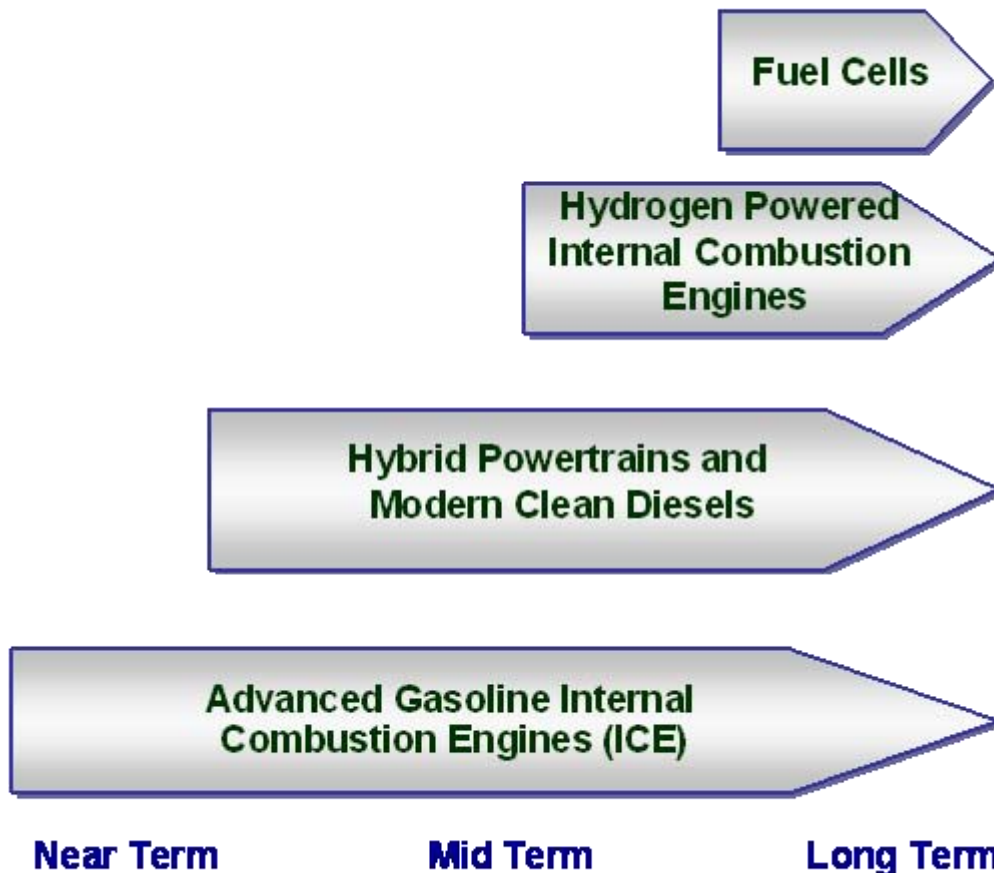


Overall Fleet Fuel Consumption: Influenced by Vehicle Miles Traveled





Pathway to the Future: Advanced Technology Vehicles



Fuel Cell: Impact in 20-30 yrs

- Endgame for the hydrogen economy
- Environmentally neutral powertrain

Hydrogen Internal Combustion Engines: Bridging technology

- Bridging action / enabler for H₂ Economy
- H₂ emissions benefits realized in near term

Hybrid Powertrain: 10-15% Mkt

- Market driven niche solution
- Benefits realized in urban driving conditions

Modern Clean Diesel: Core for next 40+ yrs

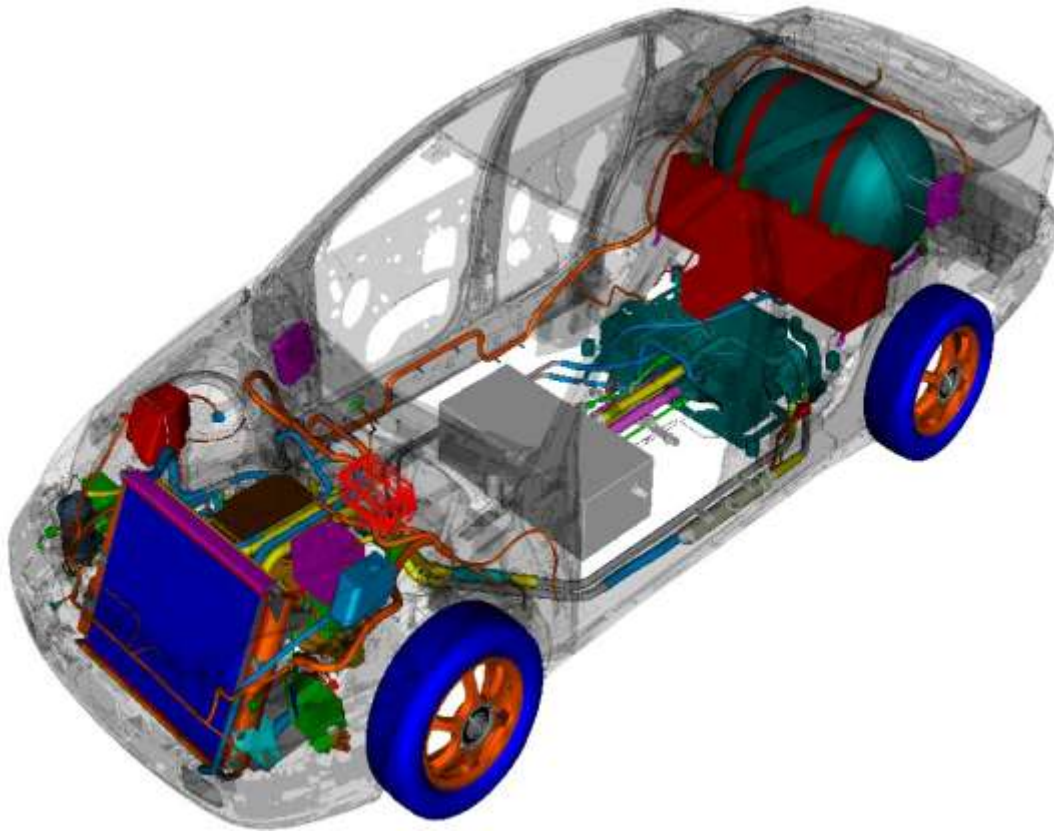
- Challenges – fuel quality, Tailpipe Emissions standards

Gasoline Engine Efficiency: Core for 30+ yrs

- Low cost, reliable, familiar
- Existing capital & refueling infrastructure



Fuel Cell Powertrains



- ✓ Hydrogen fuel cells are the highest-efficiency technology
- ✓ Currently, Ford has 30 Focus Fuel Cell Vehicles (FCVs) on the road, helping to prove out, develop and demonstrate the technology
- ✓ To be competitive, fuel cell systems must have costs several orders of magnitude lower than today



Hydrogen Powered Internal Combustion Engines (H₂ICEs)



- ✓ Key “Bridge” Technology
- ✓ H₂ICE Shuttle Bus Demonstration w/6.8L Supercharged H₂ Triton V10
- ✓ Holds up to 12 passengers plus luggage
- ✓ Worked with State of Florida, Dallas-Ft.Worth airport, Canadian government and others to launch a 2006 demo fleet



Hybrid Electric Vehicles



- ✓ “No Compromise” Escape Hybrid delivers improved fuel economy and emissions while providing SUV functionality and utility
- ✓ Over 75% fuel economy improvement in City driving
- ✓ Over 400 mile range
- ✓ Efficiency benefits with engine downsize, regenerative braking, and electric launch and drive
- ✓ Acceleration performance similar to a V-6
- ✓ Meets strict SULEV and AT-PZEV (Advanced Technology PZEV) emissions standards



HySeries Drive™ Technology with Plug-In Capability




- ✓ First drivable fuel cell HEV with plug-in capability
- ✓ Operates using a fuel cell, small gasoline or diesel engine connected to an electric generator
- ✓ Powered by a 336-volt lithium-ion battery pack (refreshed by an on-board charger from a standard home outlet)
- ✓ Drives first 25 miles on stored electricity, after which the fuel cell kicks in to keep battery charged (provides additional 200 miles range)
- ✓ Significant technical hurdles to overcome before commercialization – including fuel cell and lithium-ion battery costs



Modern Clean Diesels

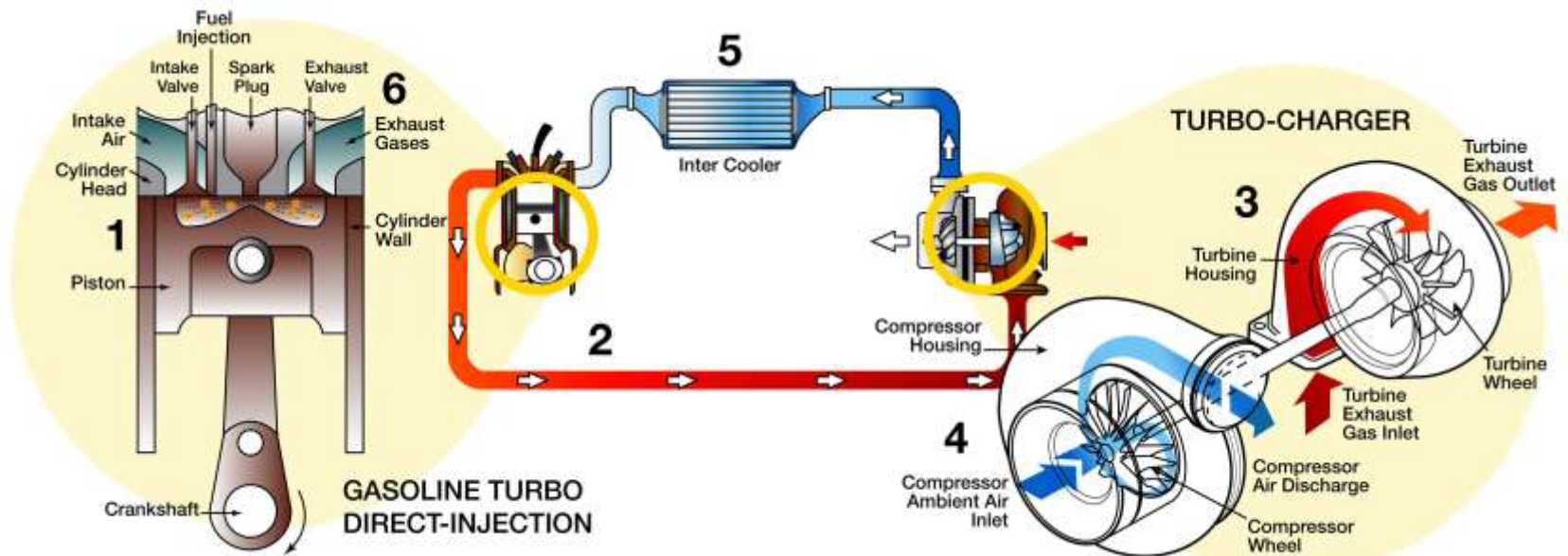


burrows  n-village

- ✓ Significant increase in fuel economy (20-30%)
- ✓ Higher performance, less noise, less odor
- ✓ Improved emissions performance



Advanced Gasoline Internal Combustion Engines (ICEs)



Below is how Ford's gasoline, turbocharged, direct-injection system operates:

- 1: A precisely controlled amount of gasoline is directly injected into the engine's cylinders at high pressures.
- 2: Exhaust gas from the engine is routed to a turbocharger.
- 3: The exhaust air drives the turbine, which drives the compressor.
- 4: The compressor then compresses the intake air.
- 5: The compressed intake air is then routed through the inter cooler and to the engine. Cooling the intake air before it reaches the engine improves combustion.
- 6: The air is then forced at high pressure into the engine cylinder mixing with high pressure gasoline.





A Pathway for Today: Ethanol (E85)



- Ethanol has been a transportation alternative fuel choice for more than 10 years
- About 3.5 billion gallons of ethanol were sold for transportation purposes in 2005
- Most U.S. ethanol is currently derived from corn
- Ethanol produced from cellulosic feedstocks planned for the future





Why Ethanol Now?

Opportunity for Immediate Impact

- Ford has placed over 2 million E85 FFVs on America's roads
- As a whole, U.S. automakers have produced more than 6 million E85 flexible fuel vehicles
- If all of these vehicles were operated on E85, over 3.6 billion gallons of gasoline a year could be displaced.
 - ✓ That's like saving a full year of gasoline consumption in a state like Missouri or Tennessee.
- Ford, GM and DaimlerChrysler voluntarily committed to doubling our production of FFVs by 2010.
 - ✓ We expanded that commitment to include half our vehicles each year by 2012, provided sufficient infrastructure is in place



What Is Needed?

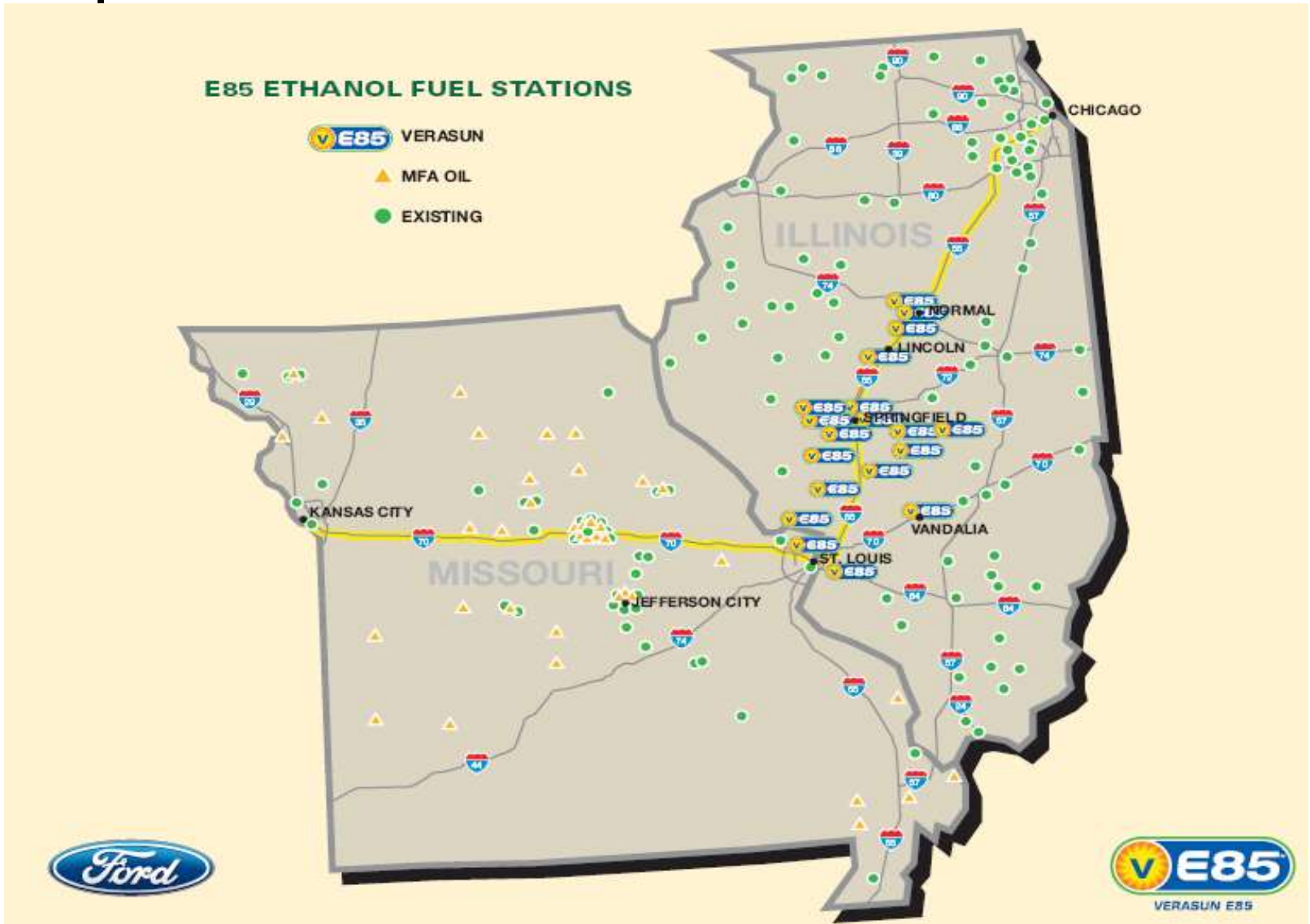
More E85 Stations Will Solve The "Chicken & Egg" Problem

E85 Availability Primarily in the Midwest (presently about 1,100 stations – out of about 170,000 retail gasoline stations nationwide)





Ford, with VeraSun, developed the Midwest Ethanol Corridor adding 50 E85 stations





Ford's 2007 Ethanol (E85) Flexible Fuel Vehicles





Flexible Fuel Vehicle Features

FFVs Provide Fueling Options:

They operate on gasoline, E85, or any blend in between

FFV Operation is Transparent to Drivers:

Engine operating parameters are constantly adjusted for optimum performance regardless of fuel blend

Typical Upgraded FFV Engine Components:

Valves and Valve Seats, Spark Plugs, Fuel Injectors, Cylinder Head Gaskets

Engine Control Computer:

Adjusts engine calibration for proper performance and to meet emission requirements on all fuel blends

Typical Upgraded FFV Fuel System Components:

Low Permeability Fuel Tank, Higher Flow Fuel Pump, Fuel Delivery Lines





Escape Hybrid E85 Demonstration Fleet



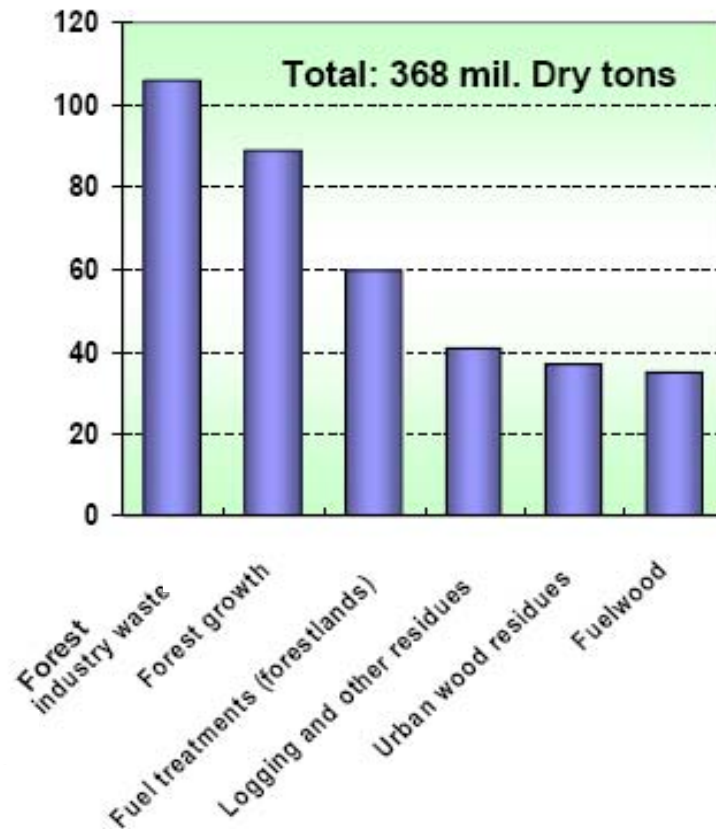
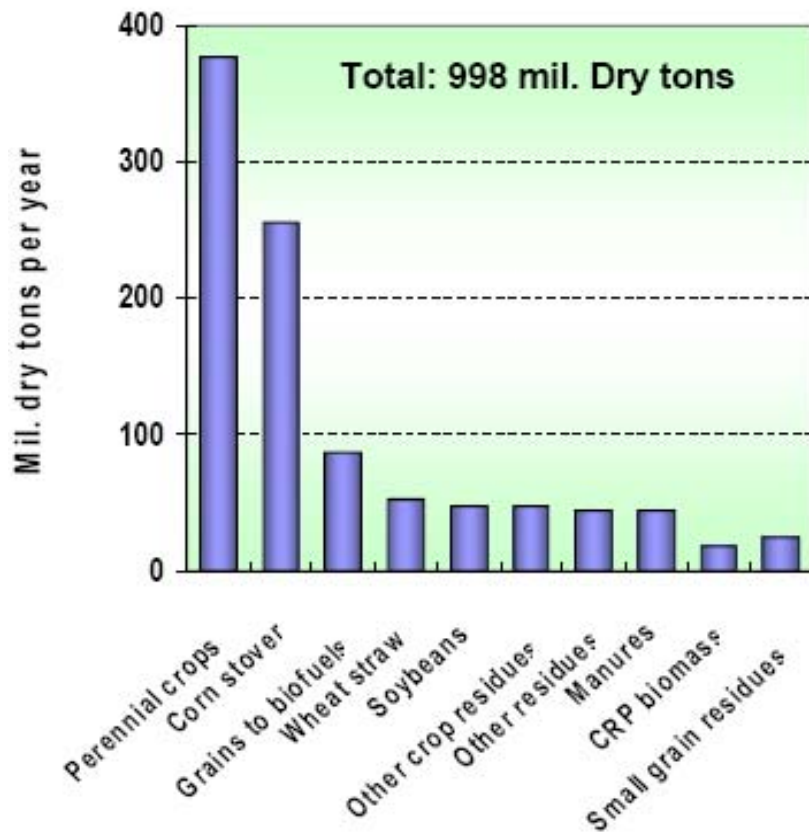
- ✓ Demonstration program marrying two petroleum-saving technologies – hybrid electric power and flex-fuel capability
- ✓ 20 vehicles will be delivered later this year
- ✓ Helps reduce dependence on imported oil
- ✓ Produces about 25% less carbon dioxide than a gasoline-fueled Escape Hybrid



Why Ethanol in the Future?

Biofuels Further Enhance Our Energy Security

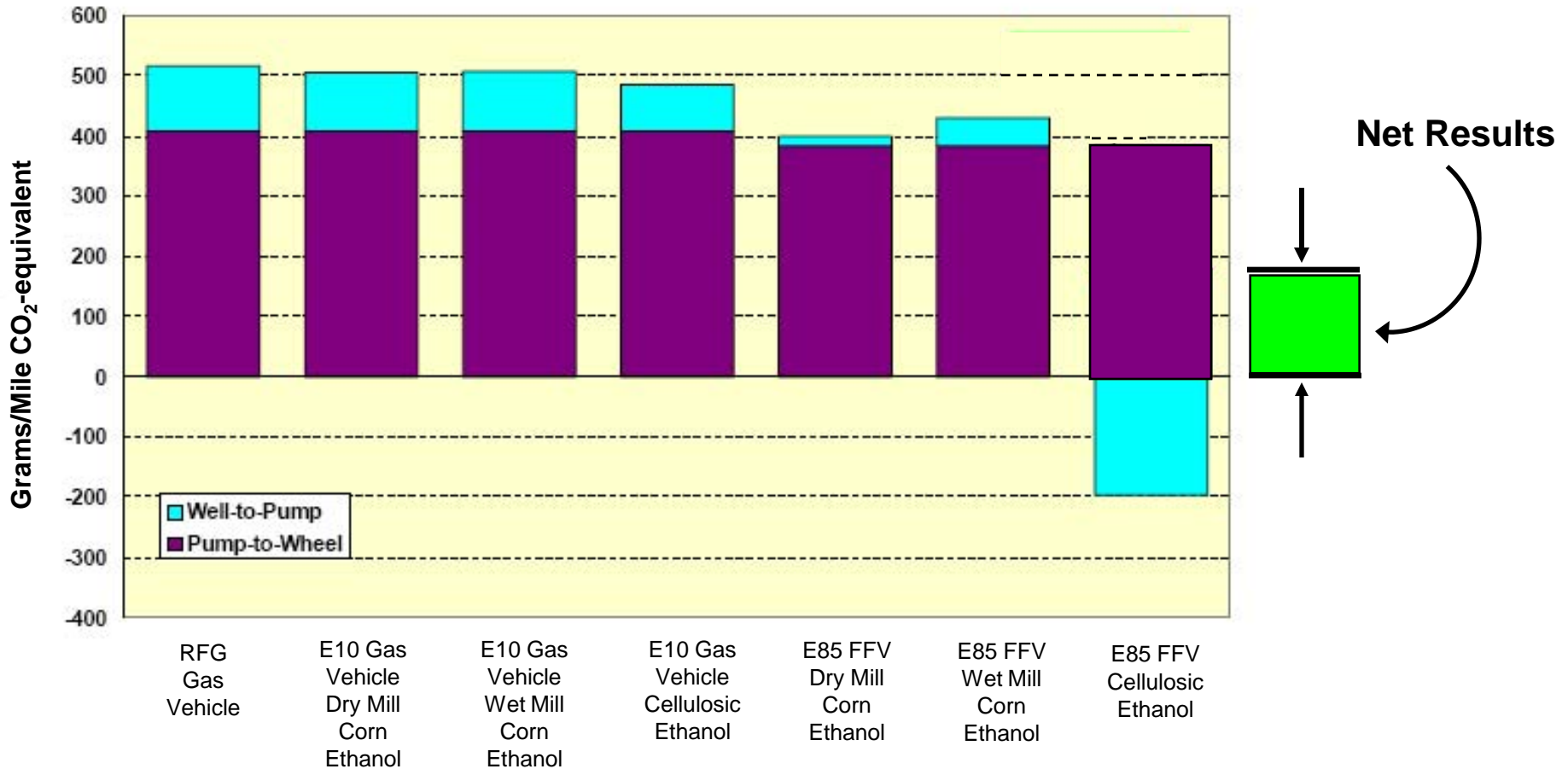
**2005 ORNL Study: 1.3 Billion Tons of Biomass Available Per Year
Enough to Displace 30% of Petroleum Consumption for Transportation**





Why Ethanol in the Future?

Significantly Lower Greenhouse Gas Emissions





The Role of Stakeholders: An Integrated Approach

Automotive Industry	<ul style="list-style-type: none">✓ Accelerate advanced technology vehicle deployment✓ Continue to improve the efficiency of our products✓ Educate consumers/provide “eco-driving” training
Fuel Industry	<ul style="list-style-type: none">✓ Invest in developing and marketing E85✓ Increase R&D into advanced low carbon bio-fuels (including cellulosic ethanol)
Government	<ul style="list-style-type: none">✓ Incentives for advanced technology vehicles & E85 fueling infrastructure development✓ Investment in improved road traffic management infrastructure✓ Public awareness and education
Consumers	<ul style="list-style-type: none">✓ Drive vehicles in an energy-conscious fashion✓ Vehicle choice and miles traveled ultimately determines how much fuel is consumed

