

The Dynamic Market for Alternative Fuels



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**Midwestern Summit for
Transportation Fueling Choice
Racine, Wisconsin**

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National Renewable Energy Laboratory

Only national laboratory dedicated solely to energy efficiency and renewable energy

- Leading clean-energy innovation for 35 years
- About 1,700 employees with world-class facilities
- Campus is a living model of sustainable energy
- Owned by the Department of Energy
- Operated by the Alliance for Sustainable Energy



The Dynamic Market for Alternative Fuels

Synopsis

- Market Overview
- Market Trends
- Technology Deployment Opportunities

Key Points

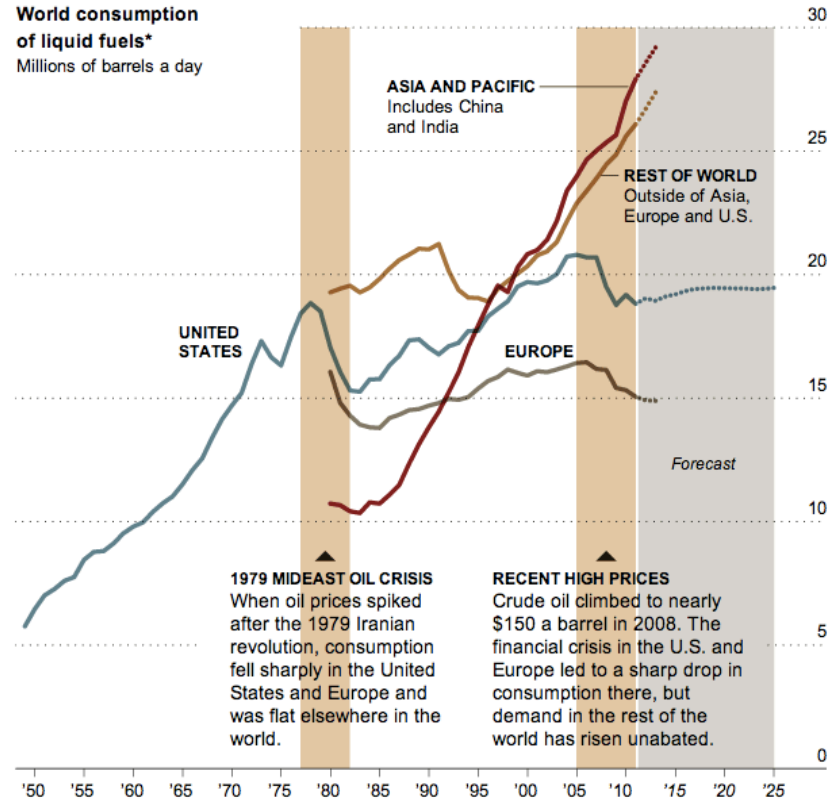
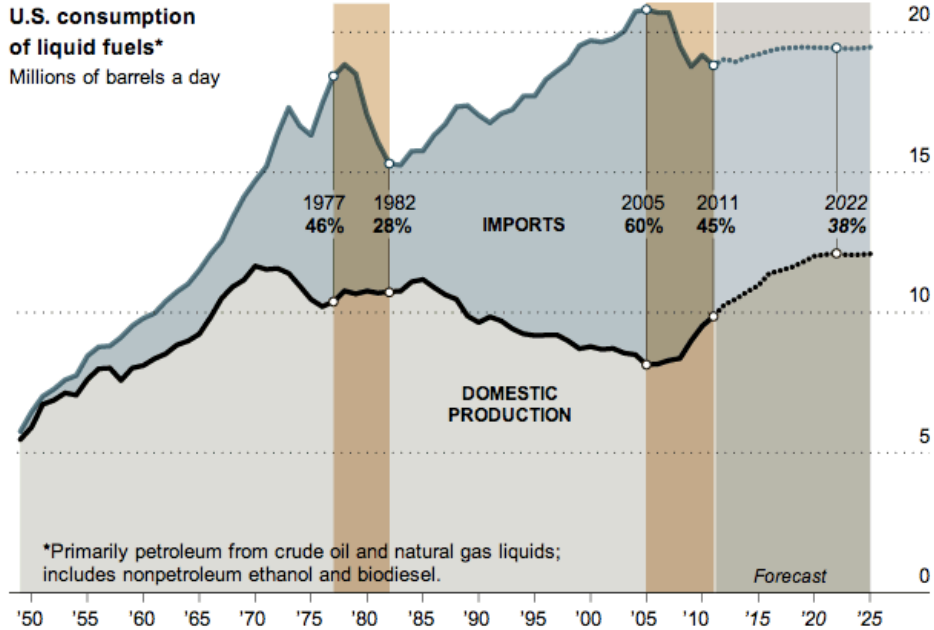
- Market Forces and Policies are Increasing Opportunities for Alternative Fuels
- Technology Advancements are Enabling New Solutions and Fundamentally Changing the Dialog
- There is No One Size Fits All, Catch All, Silver Bullet to Do it All





Market Overview

Newly Accessed Oil Supplies are Changing the Conversation



New York Times (3/22/12)

....kind of

Reduced Dependence on Foreign Oil
Decreasing Consumption
Possibility of Being Net Exporter

Market Growth Being Driven by Other Countries
Refining Capacity is Limited

We are Still Dependent on a Single Fuel

Annual U.S. Fuel Consumption

All Transportation

~93% comes from petroleum
4.9 Billion Barrels of Oil Annually

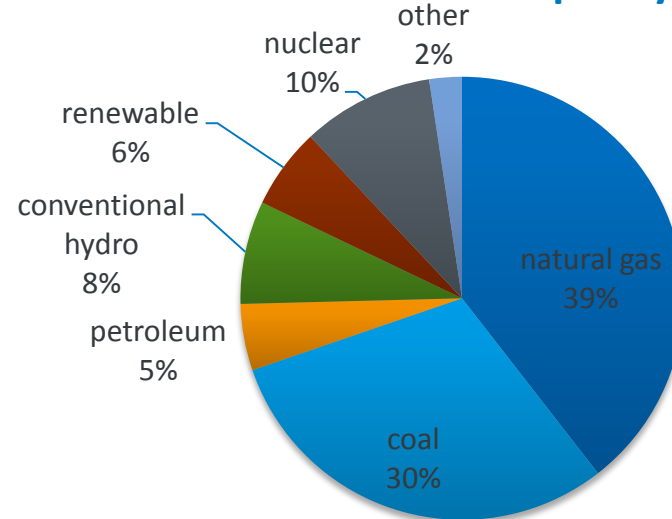
Light Duty Market

3.1 Billion Barrels of Oil Annually
63% of total petroleum use

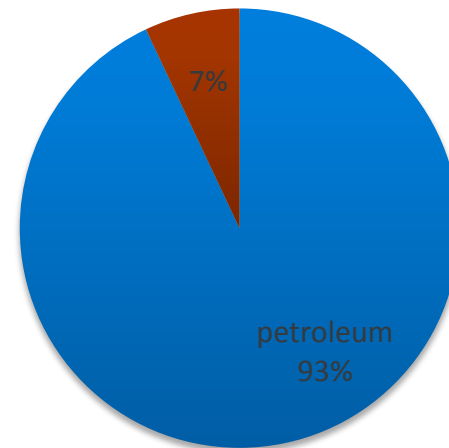
Heavy Duty Market

1.1 Billion Barrels of Oil Annually
22% of total petroleum use

Electric Generation Capacity (2011)

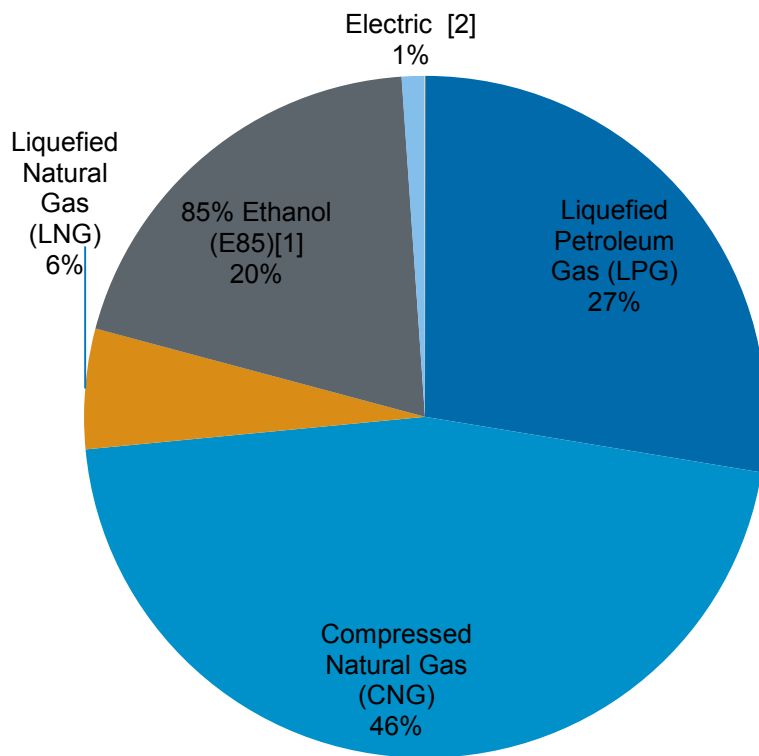


Transportation Fuels Portfolio (2011)

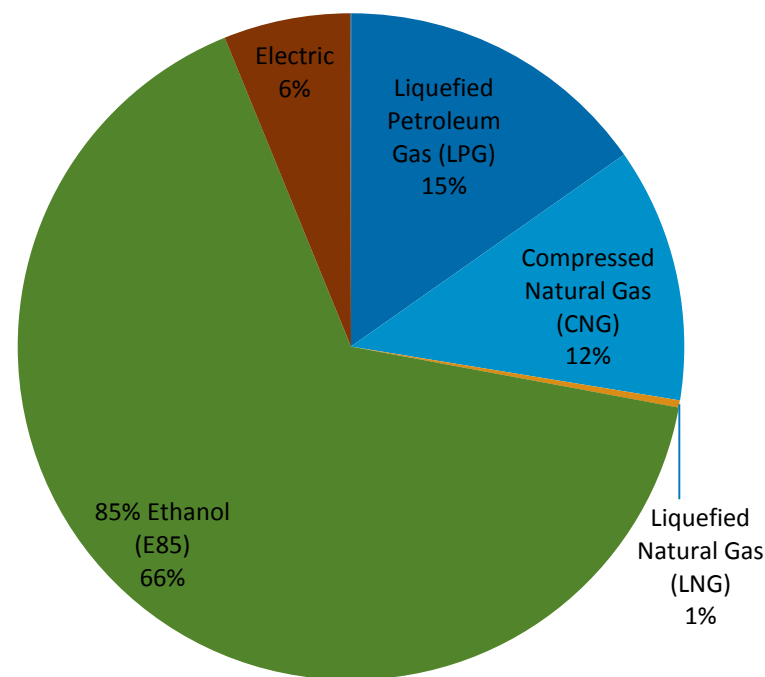


Alternative Fuel Consumption Does not Correlate with Vehicle Availability

Estimated Consumption of Alternative Fuel by AFVs in the U.S. (2010)



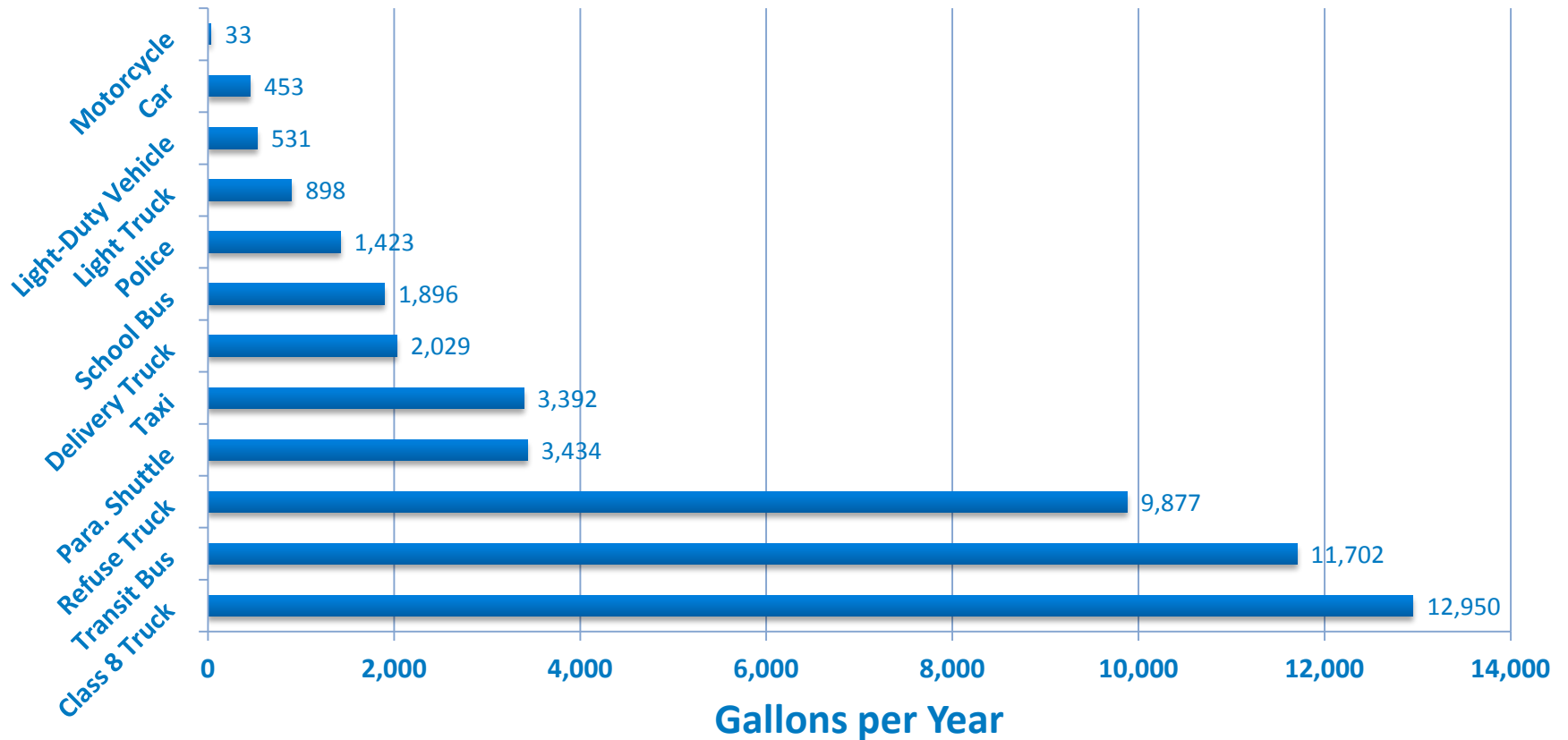
Estimated Alternative Fueled Vehicles in Use (2010)



www.afdc.energy.gov/afdc/data/

Different Vehicle Classes Have Different Needs

Average Annual Fuel Use by Vehicle Type



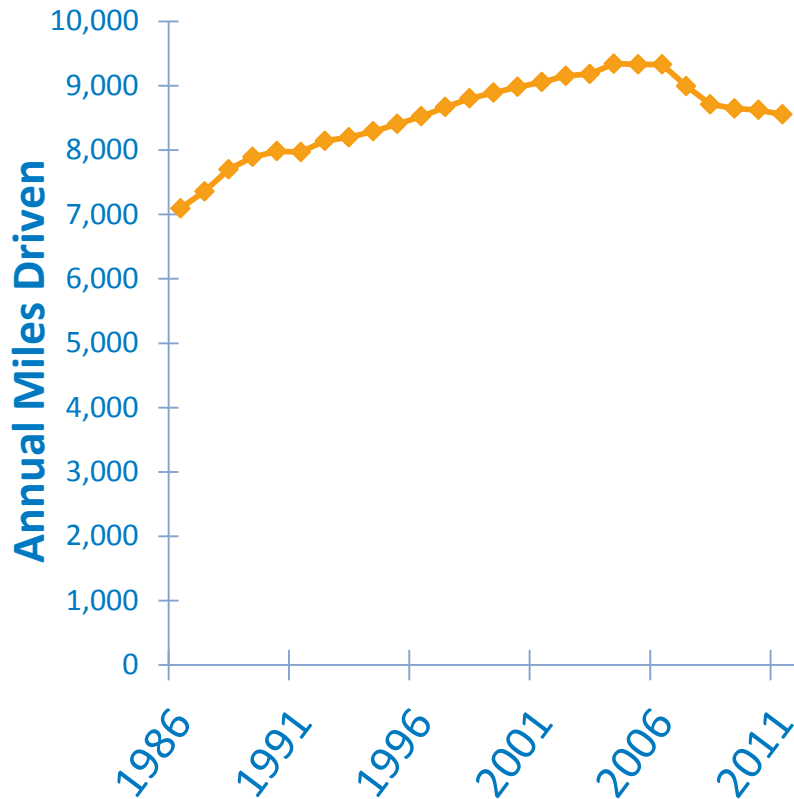
www.afdc.energy.gov/data/



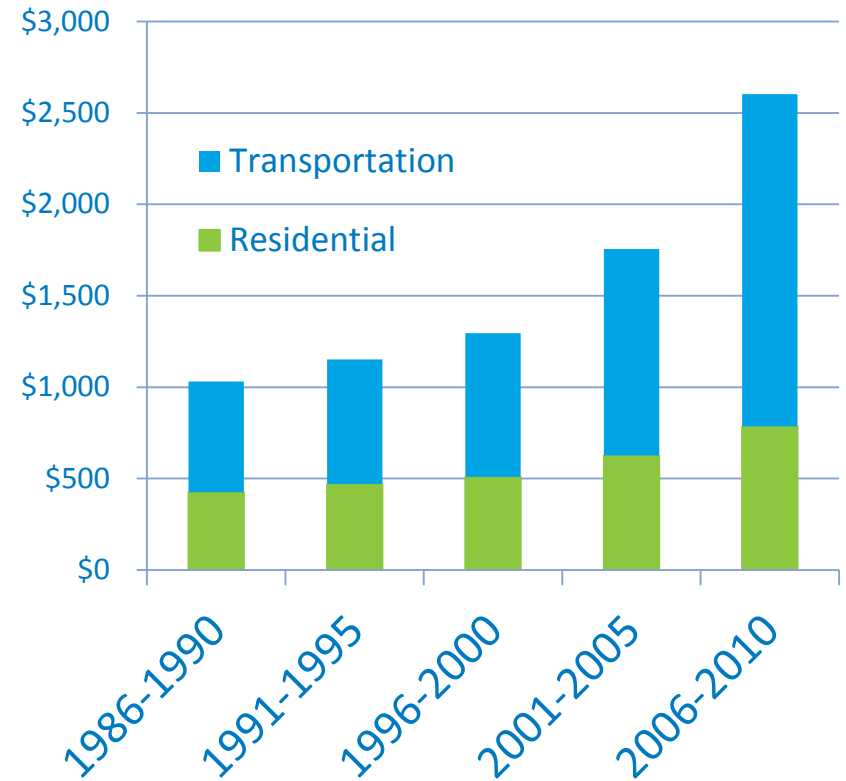
Trends and Technologies

People are Driving Less, but Spending More to Do So

Average Annual Vehicle Miles Traveled



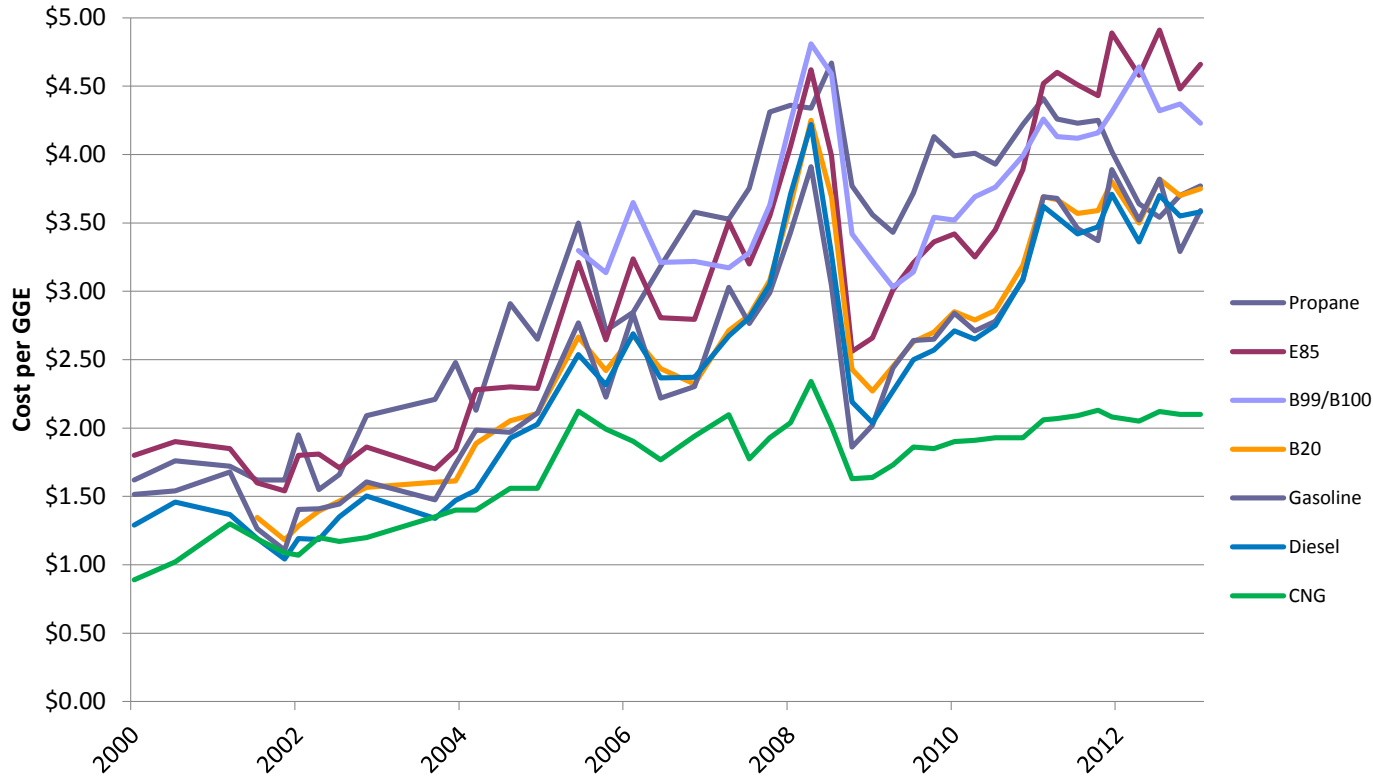
Average Per Capita Annual Energy Expenditures



Source: U.S. Energy Information Administration and U.S. DOE Alternative Fuels Data Center

The Market for Alternatives Tends to Follow Petroleum Markets, but at Different Rates

U.S. Average Retail Fuel Prices



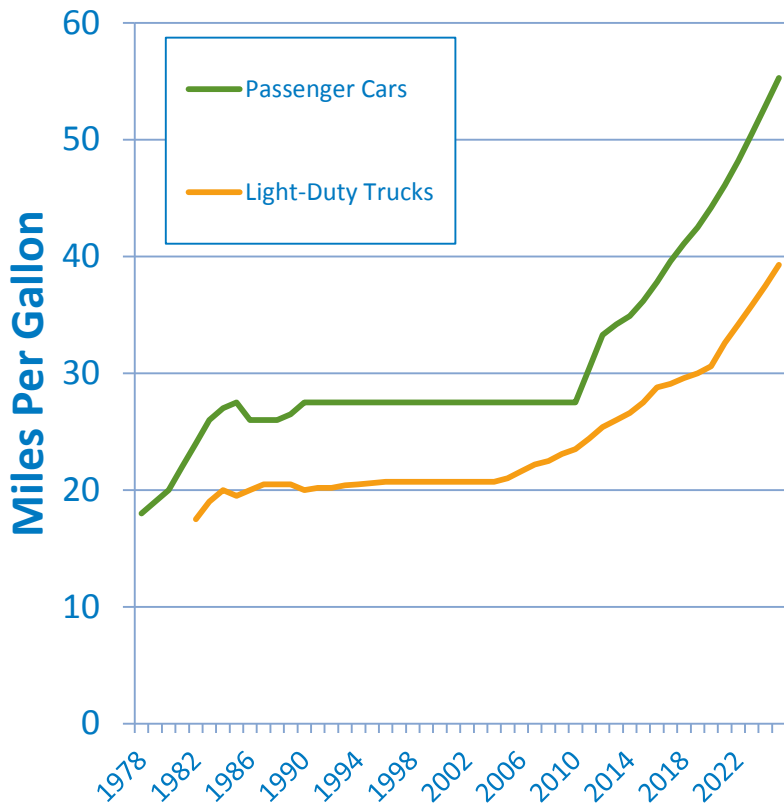
National Average Price Between March 29 and April 12, 2013	
Fuel	Price
Biodiesel (B20)	\$4.11/gallon
Biodiesel (B99-B100)	\$4.29/gallon
Electricity	\$0.117/kWh
Ethanol (E85)	\$3.30/gallon
Natural Gas (CNG)	\$2.10/GGE
Propane	\$2.73/gallon
Gasoline	\$3.59/gallon
Diesel	\$3.99/gallon

Source: [Alternative Fuel Price Report, April 2013](#) and [U.S. Energy Information Administration](#)

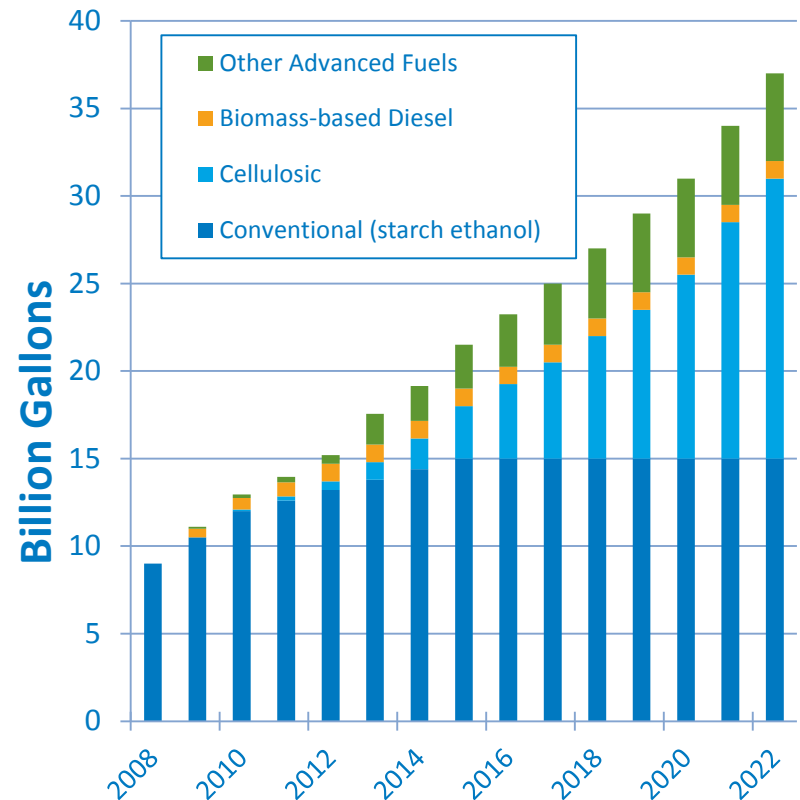
www.afdc.energy.gov/data/

National Policies are Shaping the Market

CAFE Standards



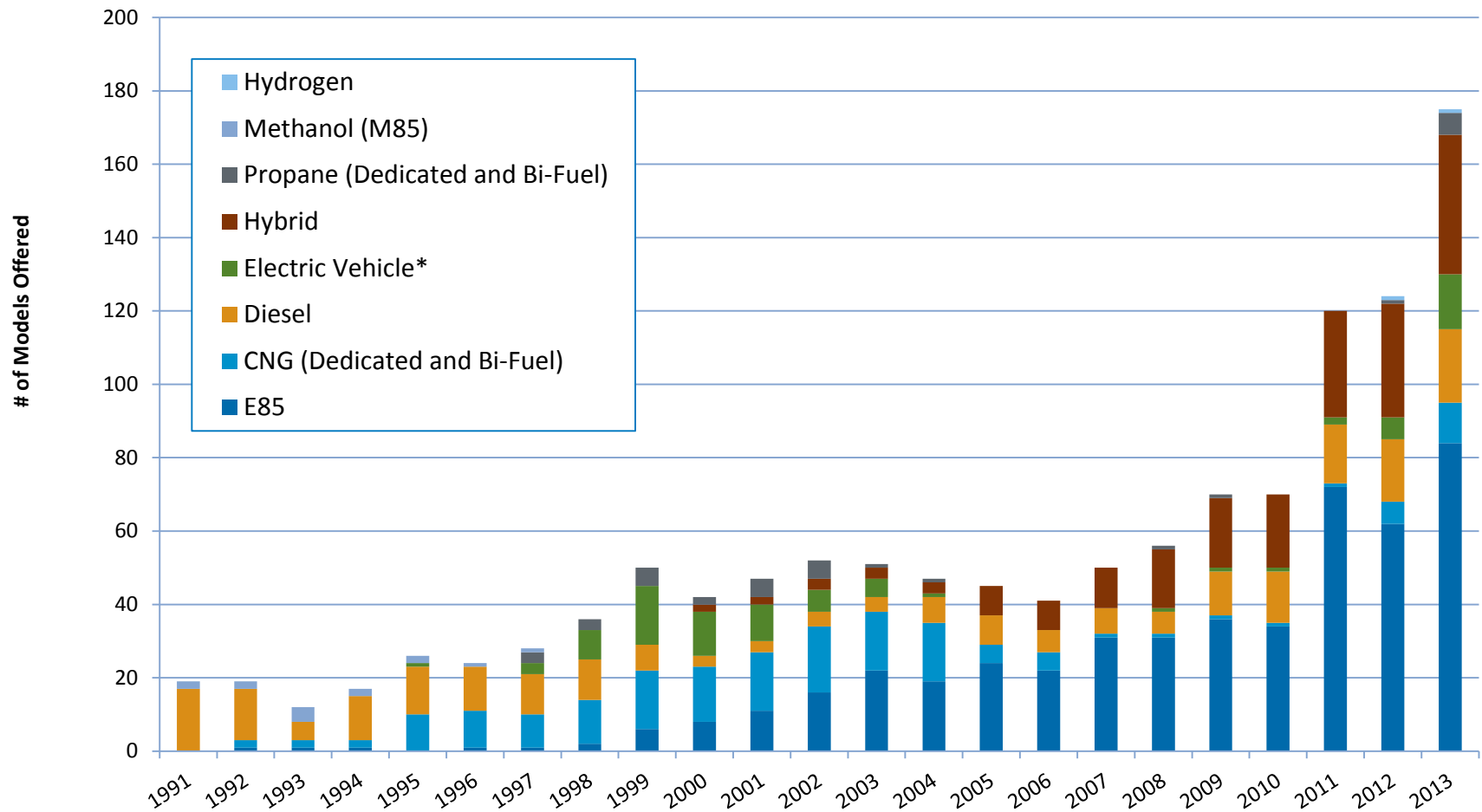
Renewable Fuel Standard II



www.afdc.energy.gov/afdc/data/

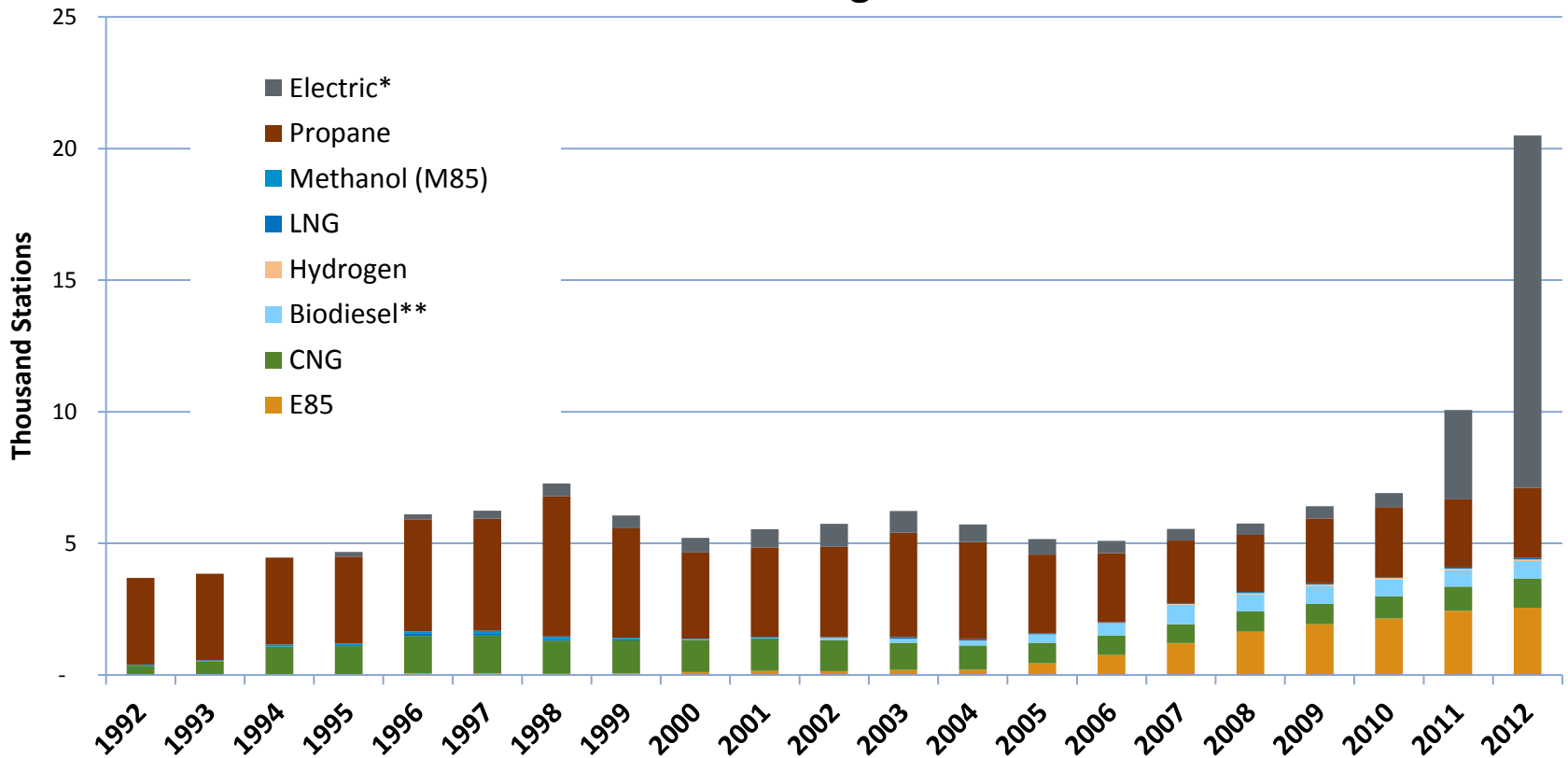
Vehicle Manufacturers are Responding

AFV/HEV/Diesel Light Duty Model Offerings by Fuel Type, 1991-2013



As are “Fuel Providers” ...

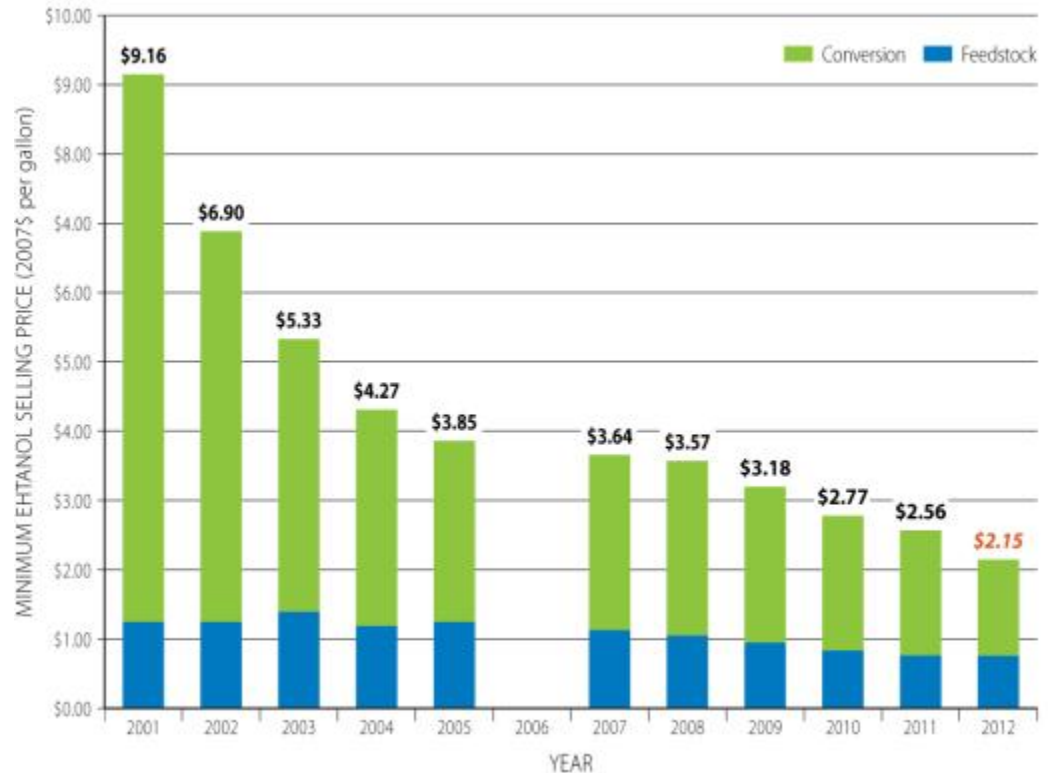
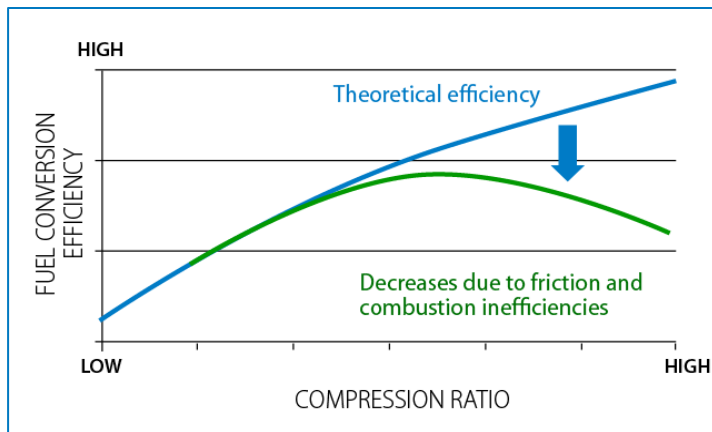
U.S. Alternative Fueling Station Count



The Wall of Opportunity for Ethanol

Renewed Discussions around Biofuels Market and Renewable Fuel Standard

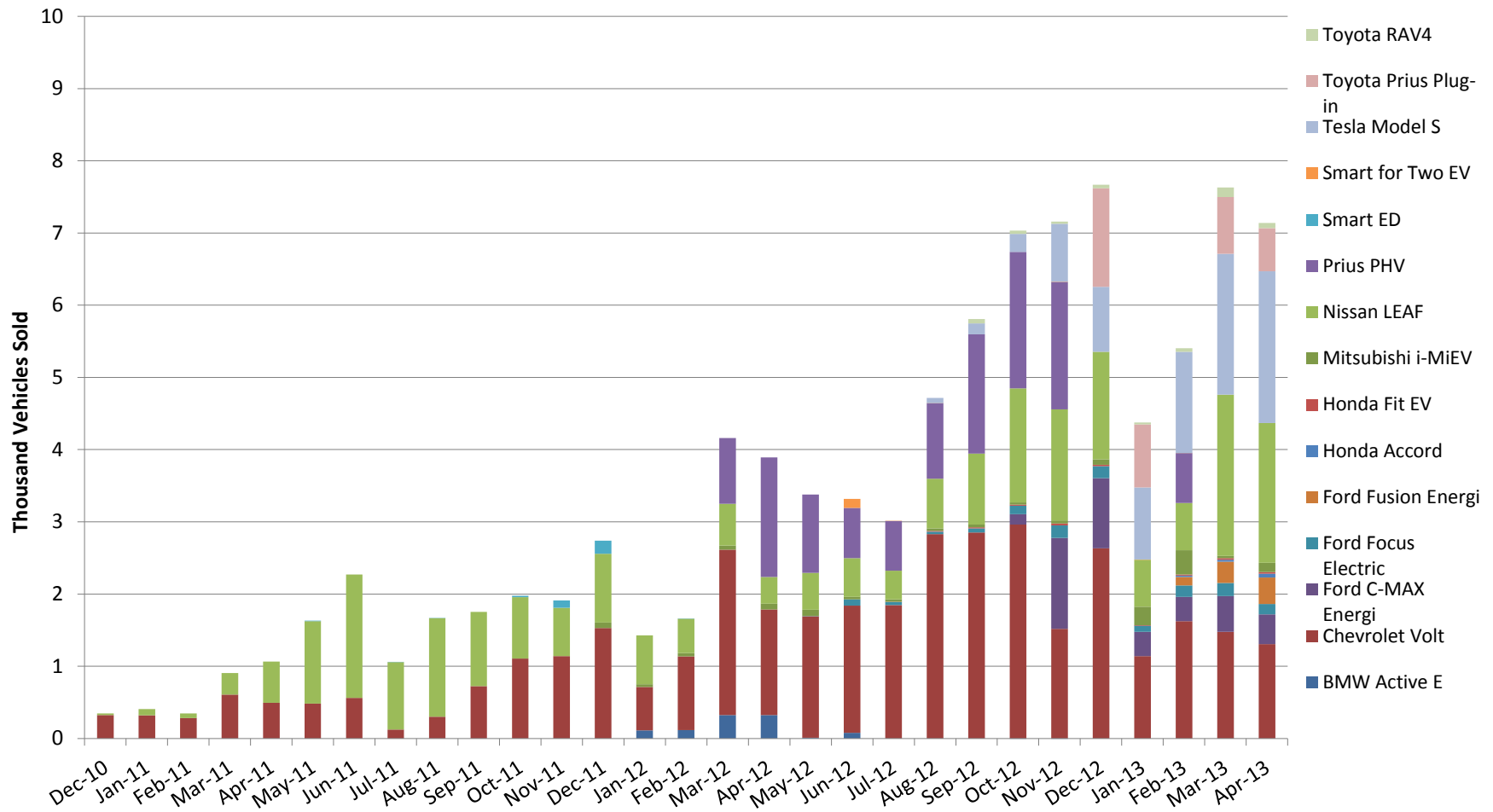
- Blend wall is approaching
- E10 to E15
- Discussions around mid-level or optimal blends (i.e. E30)
- Deploying cellulosic ethanol into the market



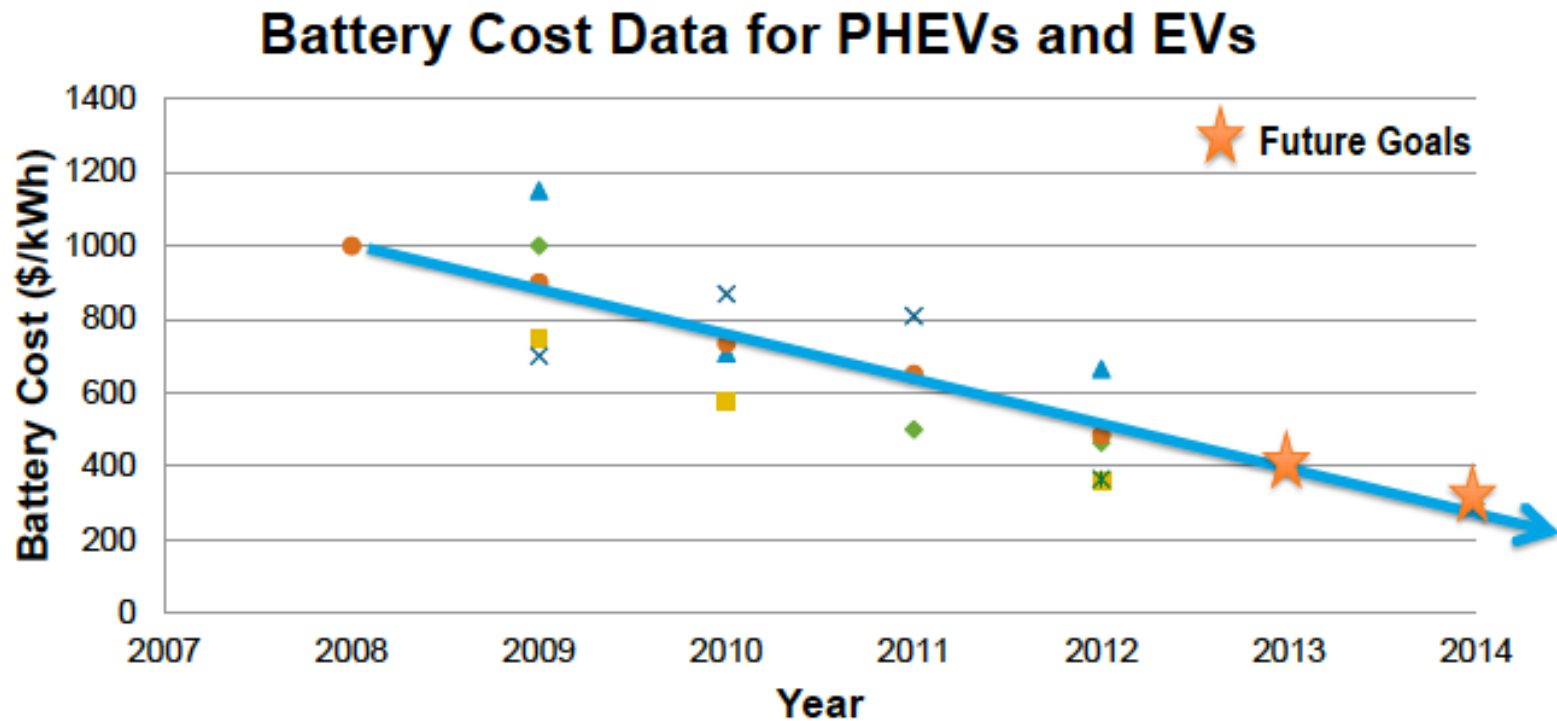
Modeled minimum selling prices for cellulosic ethanol during the past 12 years

The Marketshare of PEVs is Growing

PEV Monthly Sales by Make and Model, 2010-2013



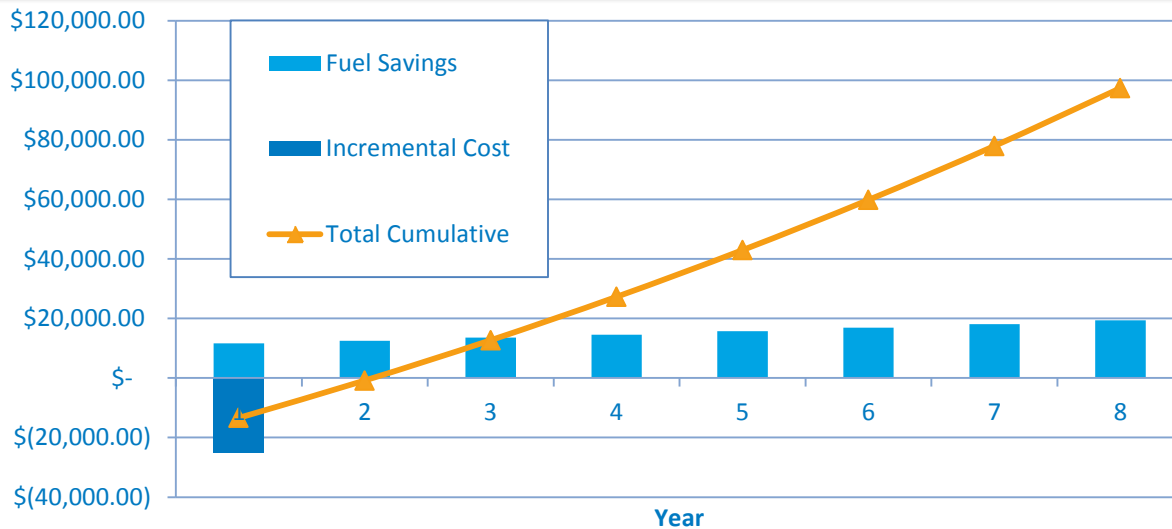
And Battery Costs are Falling



As DOE expanded its focus from HEVs to PHEVs in 2008, the cost of useable energy at the system level of program deliverables has decreased from about \$1000/kWh to just under \$500/kWh. DOE's goal in 2022 is \$125/kWh.

Source: DOE Vehicle Technologies Office Presentation on 5/14/13

Natural Gas Vehicles are Doubling Down on Green

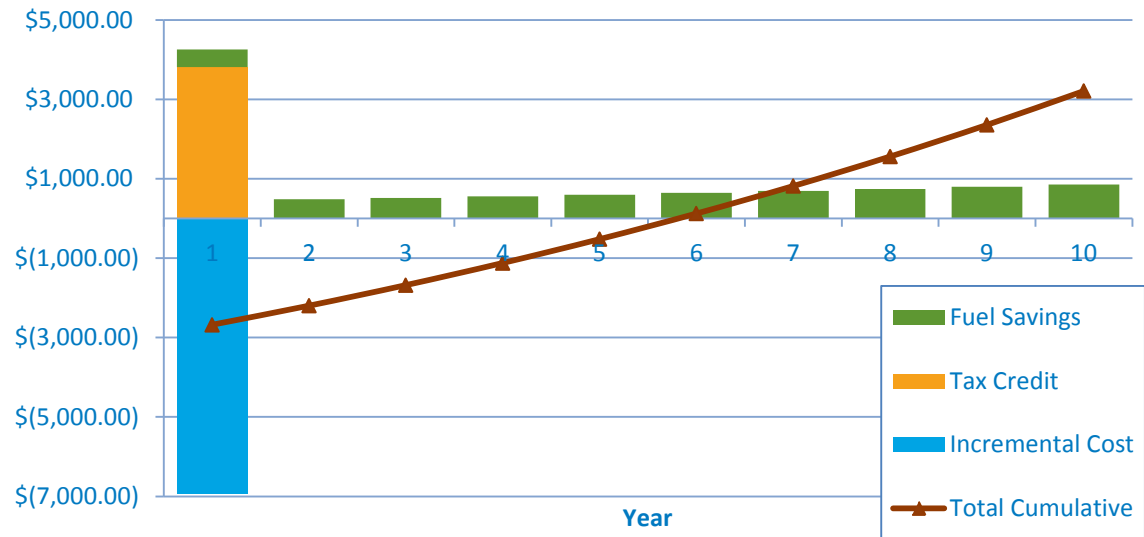


Savings for a typical CNG refuse truck over 8 years

Assumptions: \$1.50/gal initial price differential; 7500 gpy; 3% annual increase in CNG price; 5% annual increase in diesel price.

Assumptions: Same as with refuse truck, except 12000 miles/year at EPA tested MPG.

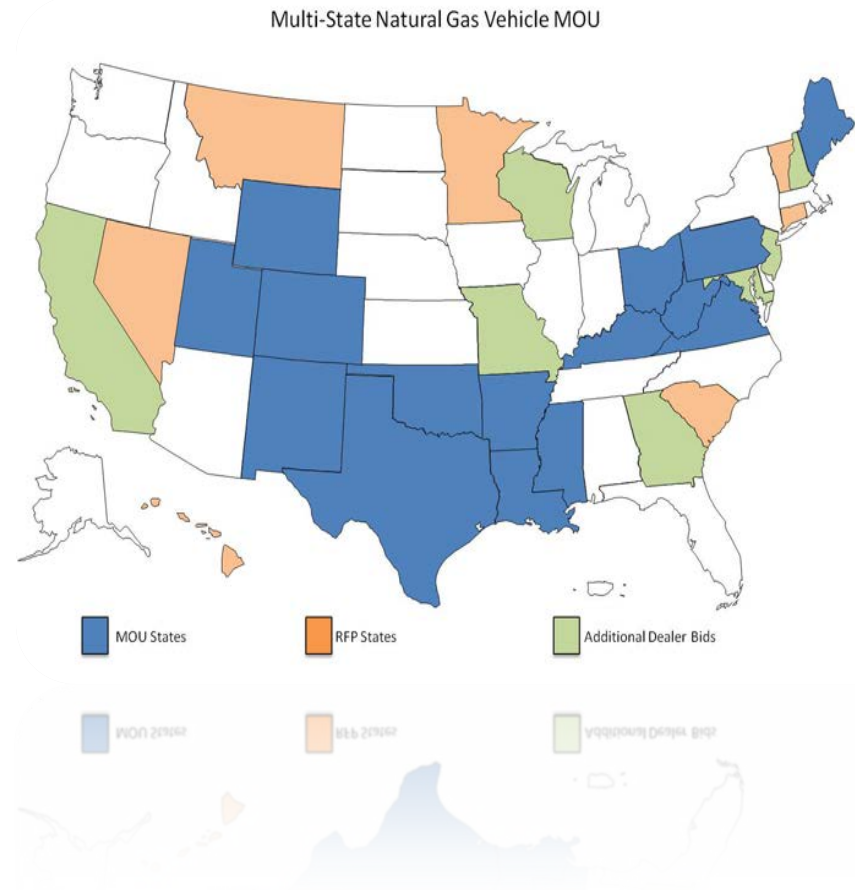
Savings for a typical CNG Honda Civic over 10 years



Multi-State Natural Gas Vehicle MOU

Multi-State Memorandum of Understanding

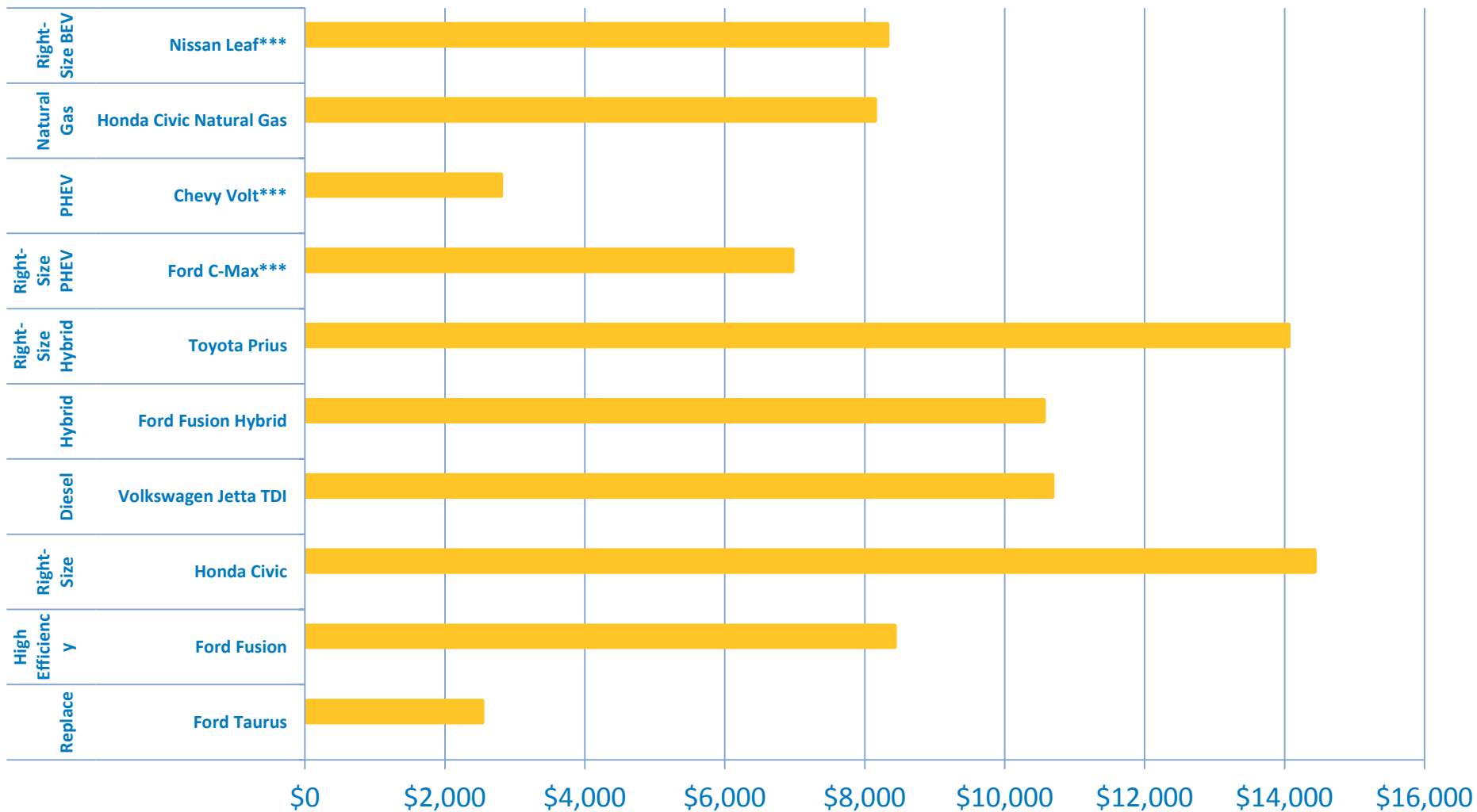
- ✓ 16 Governors agreed to aggregate state vehicle procurement in a Joint RFP; utilize local distribution networks
- ✓ Engage local government in procurement to the extent practicable
- ✓ OEM NGV should have comparable performance and price to a gasoline vehicle
- ✓ Encourage private investment in NGV infrastructure
- ✓ Reach out to fellow Governors to encourage participation
- ✓ Vehicle orders are currently being filled for 1st year effort



Business Models are and Should Continue to Evolve



Finance Can Help Answer the Age Old Question – What Do I Do With My Old Ford Taurus?



8-Year Net Savings from Petroleum Reduction by Replacing a 2001 Ford Taurus

For Illustrative Purposes Only

Clean Cities – Supporting Local Solutions

Clean Cities Mission

To advance the energy, economic, and environmental security of the U.S. by supporting local decisions to reduce petroleum use in transportation.

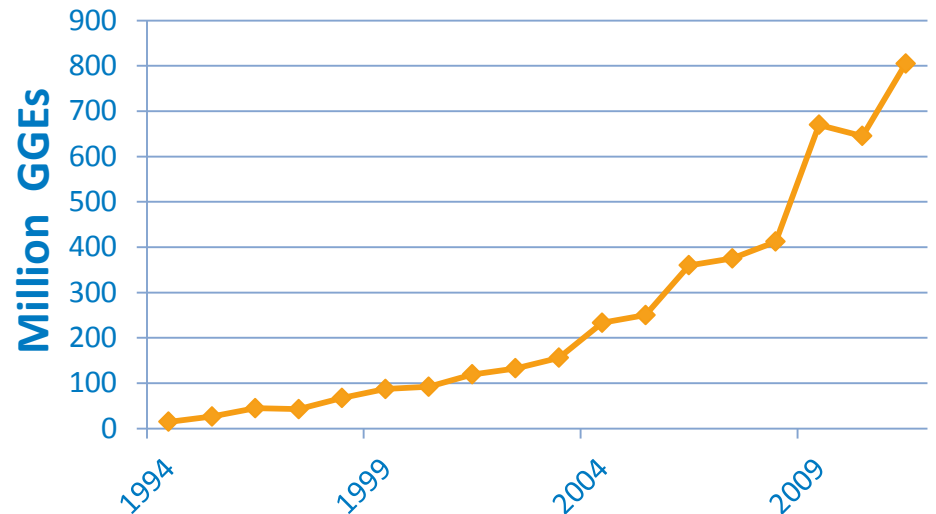
Nearly 100 coalitions throughout the United States

Coalitions are made up of local and national stakeholders.
- 13,000 stakeholders nationwide (public and private)

Clean Cities has saved nearly 4.5 billion gallons of petroleum since 1993.



Clean Cities Annual Petroleum Savings



Questions?

