

**ULTRA-LOW SULFUR
HIGHWAY DIESEL FUEL
(15 ppm Sulfur Maximum)**

Required for use in all model year
2007 and later highway diesel
vehicles and engines.

Recommended for use in all diesel
vehicles and engines.



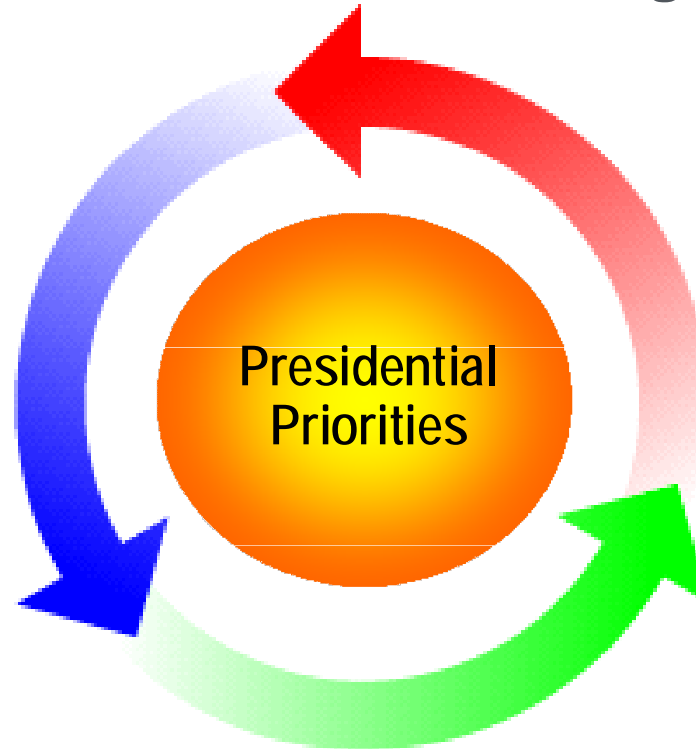
SAE 2010 Government/Industry
Meeting
January 28, 2010

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and Renewable Energy

Energy efficiency and renewable energy research, development, and deployment activities help the Nation meet its **economic**, **energy security**, and **environmental** challenges concurrently.

Energy Security

- Deploy the cheapest, cleanest, fastest energy source – energy efficiency
- One million plug-in hybrid cars on the road by 2015
- Develop the next generation of sustainable biofuels and infrastructure
- Increase fuel economy standards



Economic

- Create green jobs through Recovery Act energy projects
- Double renewable energy generation by 2012
- Weatherize one million homes annually

Environmental

- Implement an economy-wide cap-and-trade program to reduce greenhouse gas emissions 80 percent by 2050
- Make the US a leader on climate change
- Establish a national low carbon fuel standard

Accelerate revolutionary change in our Nation's energy economy in three distinct program & three cross-cutting areas:

- Energy Efficiency
- Advanced Fuels and Vehicles
- Clean Energy Generation

Cross-cutting Items

- Education and Outreach
- Recovery Act Implementation
- Management and Leadership



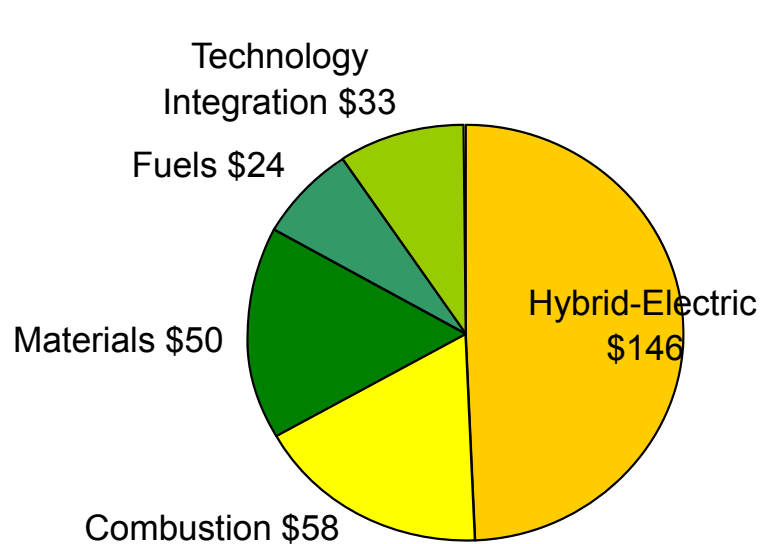
DOE's Investment in Advanced Vehicle Technologies...

...accelerates the technologies needed to reduce the Nation's dependency on petroleum, reduce emissions and provides a new workforce for tomorrow

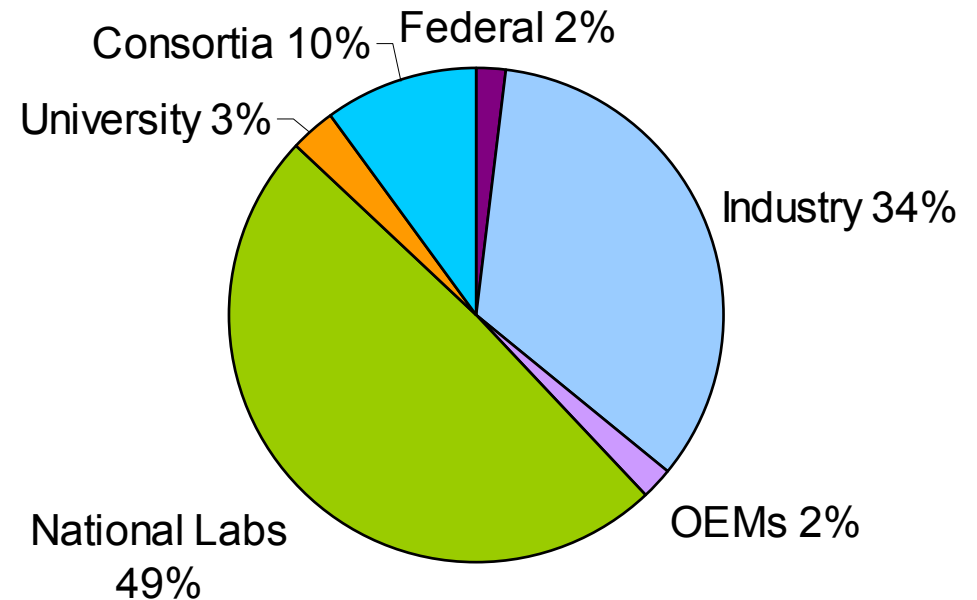
Game Changers

- Lithium-Ion batteries to enable mass commercialization of electric-drive: \$300/kW, 15 yr life, 3,000 cycles, abuse tolerant
- Improve freight efficiency of class-8 truck 50 percent

FY 2010 Budget \$311 M



Distribution of Funding by Sector

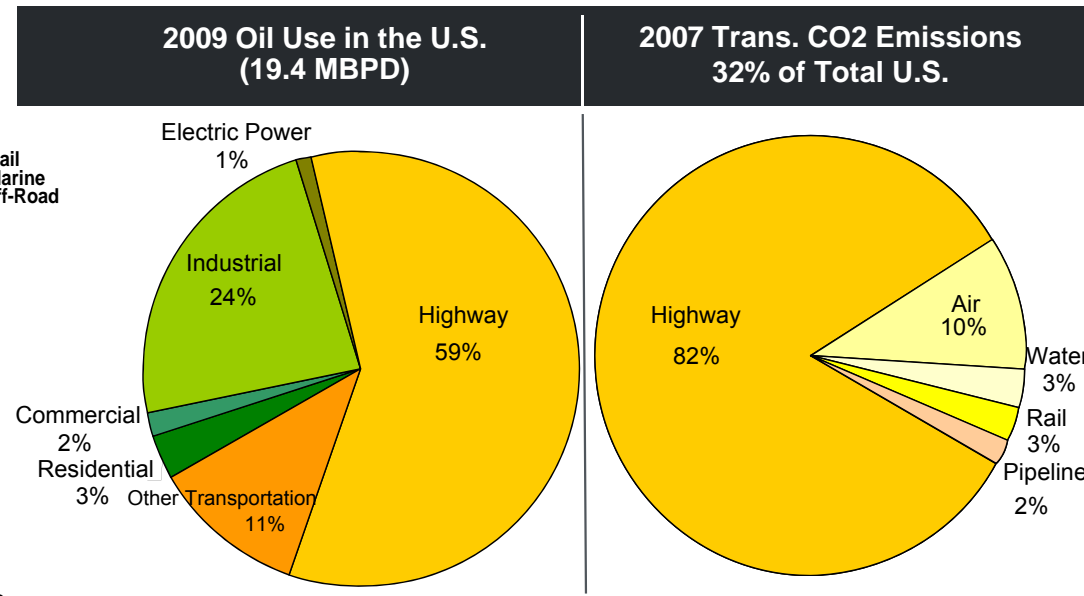
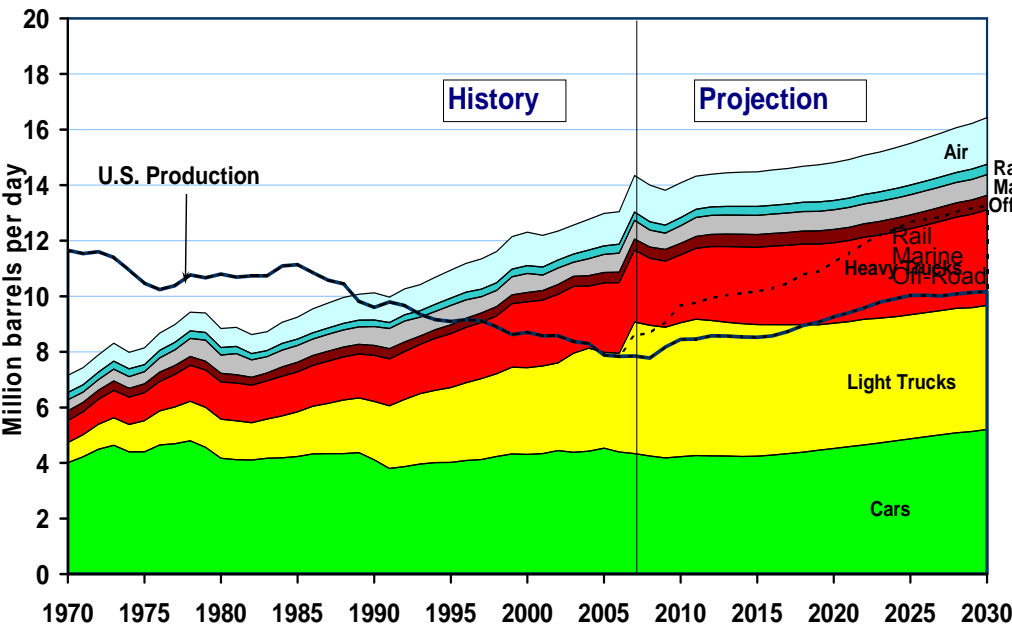


Vehicle Technologies Mission, Goals and Targets

Mission: Develop more energy efficient highway transportation technologies to enable America to use less petroleum

Key Administration Goals Relevant to Vehicle Technologies

- One million PHEVs on the highway by 2015
- Reduce oil use in 10 years by an amount equivalent to today's imports from the Middle East and Venezuela (~3.5 mbpd). The transportation share of this goal is estimated as ~1.75 mbpd.



Petroleum Displacement through Fuel Substitution and Improved Efficiency

Administration Goal: 1 Million PHEVs by 2015

Battery Cost Reduction

- Cell materials & fabrication represents about 3/4 the cost for PHEV batteries
- For significant cost reduction, new materials with increased energy density are needed to reduce:
 - material needs
 - cell count, and
 - cell/pack hardware

Types of Vehicles and Benefits

HEV



Toyota Prius → **50 MPG**
 • 1 kWh battery
 • Power Rating: 80kW
 • System Cost: \$3000

PHEV



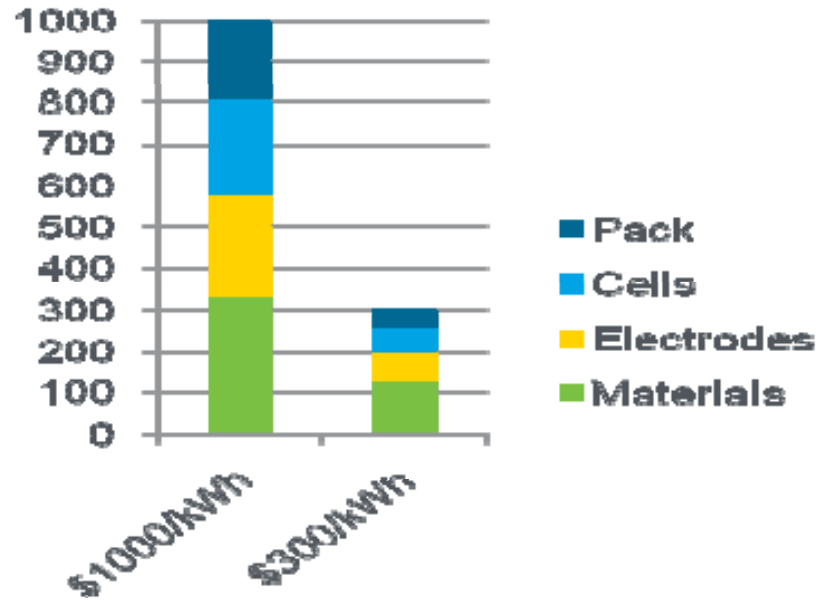
Chevy Volt → **~100 MPGe**
 • 16 kWh battery
 • Power Rating: 170kW
 • System Cost: est. \$16,000

EV



Nissan Leaf → **All Electric**
 • ≥ 40 kWh battery
 • Power Rating: ≥ 110kW
 • System Cost: est. \$36,000

Cost of Batteries



Increasing engine efficiency is one of the most cost-effective approaches to increasing fuel economy

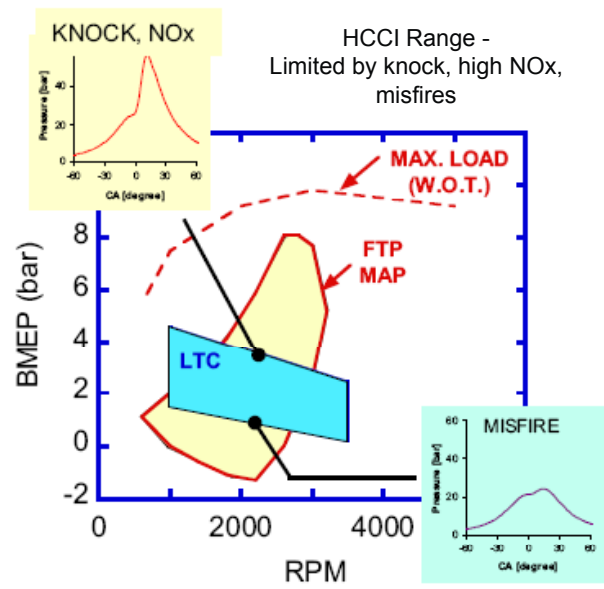
R&D Focus

Advanced Combustion Regimes (HCCI / low temp combustion)






- Demonstrate diesel-like efficiency (>45%) with less than 0.07 g/mi NOx emissions
- Complex combustion modeling for fuels -reduce reaction paths from thousands to less than 100
- Computational fluid dynamics (CFD) engine models for HCCI - reduce processing time by 90% for use by industry

Waste Heat Recovery – Mechanical and Thermoelectric Devices

- Increase practical ZT from 1.2 (current) to >2 for 20% conversion efficiency
- Increase durability of the thermoelectric systems for 15 year life
- Develop capability to process 12K tons/yr of thermoelectric material



Benefits All Vehicle Classes

Light-Duty	Cars → • Power Rating: 100-300hp		25-40% Improvement
	Trucks → • Power Rating: 200-400hp		
Heavy-Duty	Class 2b-8 → • Power Rating: 250-600hp		Up to 50% Improvement
			
			

“Support improved mileage performance of internal combustion engines...” – Secretary of Energy Steven Chu

Vehicle lightweighting is one of the most cost effective ways of reducing fuel consumption resulting in a 6-8% improvement in fuel economy with every 10% reduction in vehicle weight

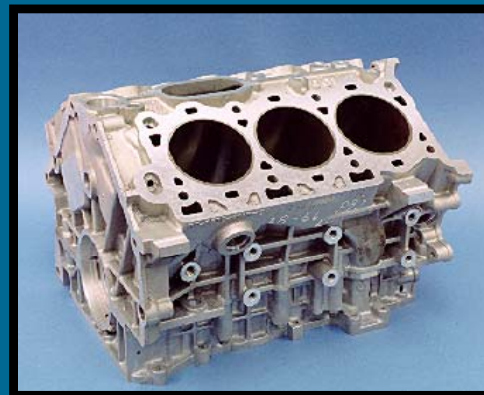
Types of Materials and Benefits

Carbon Fiber



50-60% Lighter than a Standard Steel Body in White

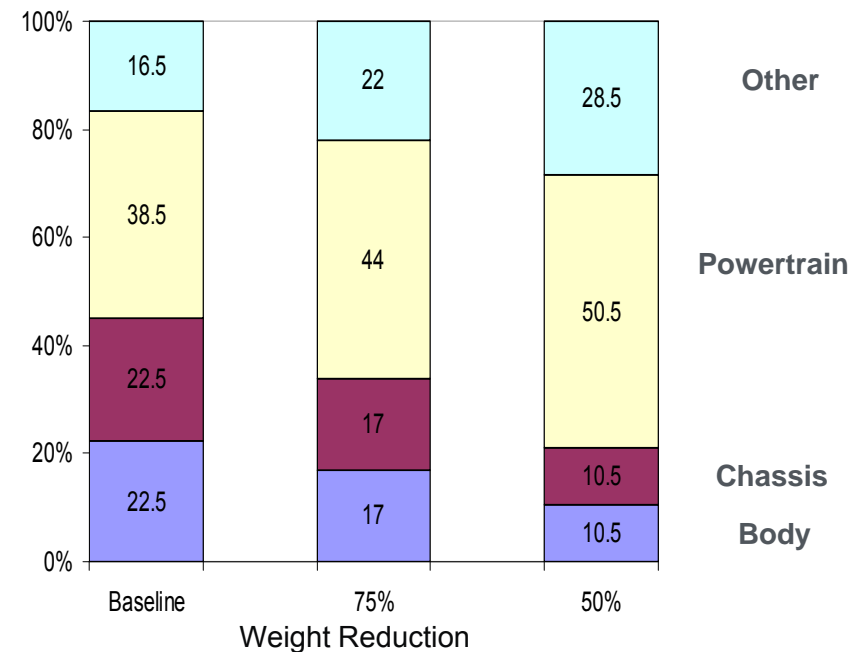
Magnesium



25-35% Lighter than an Aluminum Engine Block and 45-55% Lighter Compared to Cast Iron

Weight Reduction of 50% Possible

- Through weight decomposing only 20-25% of primary weight reduction required.
- Key Materials: Carbon fiber, Mg alloys, high strength steel.
- Changes vehicle weight distribution.



Weight Decomposing is an iterative solution: Lower overall weight reduces the engine size required, which in turn reduces weight, which in turn allows the vehicle structure to be reduced, etc.

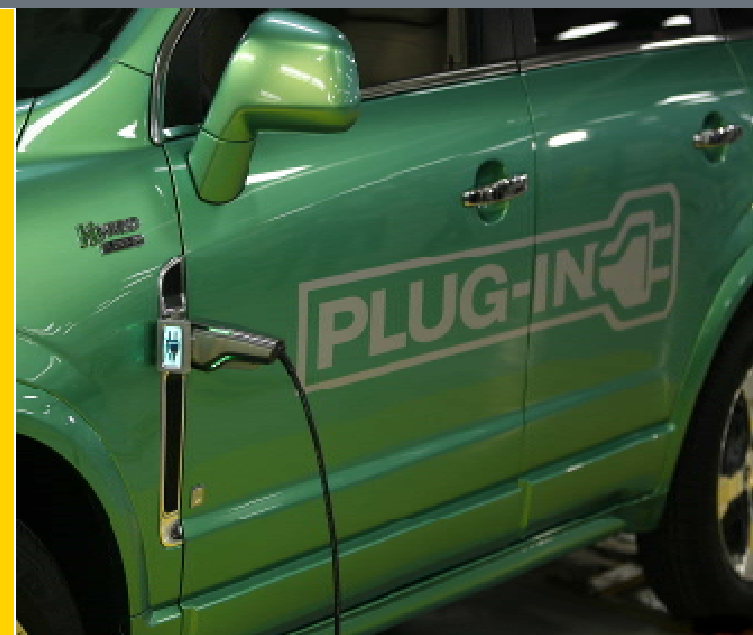
Vehicle Technologies Recovery Act Funding – 2.8 Billion

\$1.5 Billion in funding to accelerate the manufacturing and deployment of the next generation of U.S. batteries

\$500 Million in funding for electric-drive components manufacturing

\$400 Million in funding for transportation electrification

Recovery Act will fund **48 new projects** in advanced battery and electric drive components manufacturing and electric drive vehicle deployment in over **20 states**. Directly resulting in the creation **tens of thousands of manufacturing jobs** in the U.S. battery and auto industries



\$300 Million in funding for Clean Cities

The Recovery Act funding for state and local governments, and transit authorities will expand the nation's fleet of clean, sustainable vehicles and the fueling infrastructure necessary to support them.

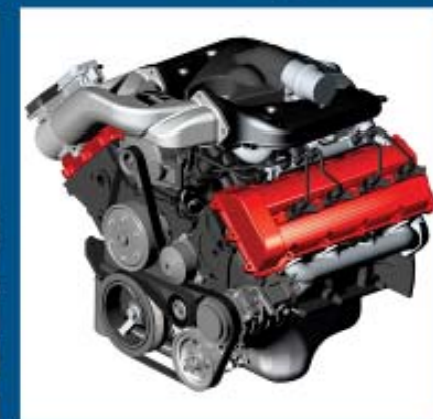
\$100 Million Solicitation for SuperTruck and Advanced Combustion R&D

Heavy-duty trucks are emphasized because they rapidly adopt new technologies and account for 20% of the fuel consumed in the United States.



Major Outcomes of ARRA

- Of the \$1.5 billion in grants to U.S. based manufacturers to produce highly efficient batteries, over 80% of the ARRA funds managed by the VT program has already been awarded.
- Awards will result in more than **50,000 manufacturing jobs** in the battery and auto industries in the United States.
- Installation of over **13,000 charging sites**, more than have ever been installed in the U.S. The majority will be concentrated around Phoenix, San Diego, Smyrna and Nashville (Tennessee), and Seattle.
- Collection of in-use, operational, and charging data on more than **5,000 PHEVs** – the largest number of PHEVs ever on the road in the U.S.



President Obama has said, "If we want to reduce our dependence on oil, put Americans back to work and reassert our manufacturing sector as one of the greatest in the world, **we must produce the advanced, efficient vehicles of the future.**"



THANK YOU