Vehicle Technologies Program

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Global Energy and Environment Initiative

Patrick B. Davis
Program Manager

Analysis Informs Strategy

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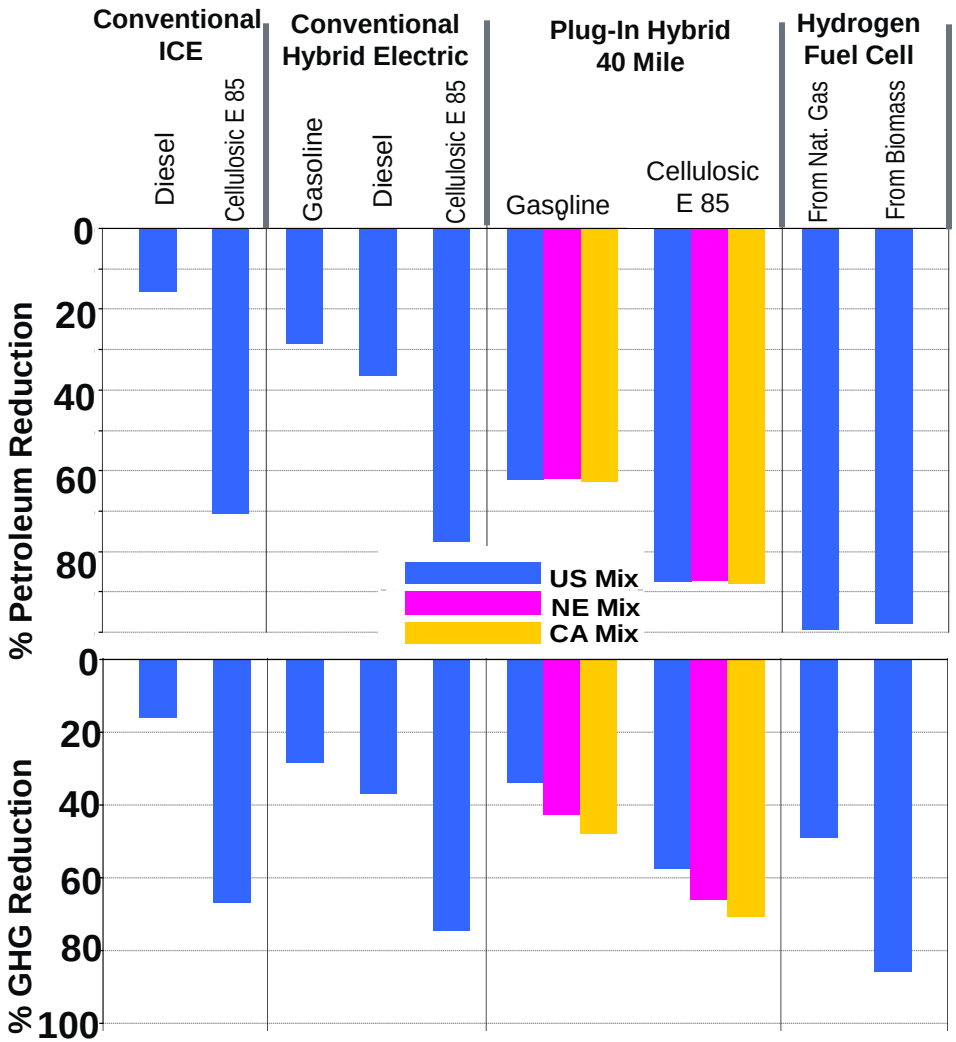
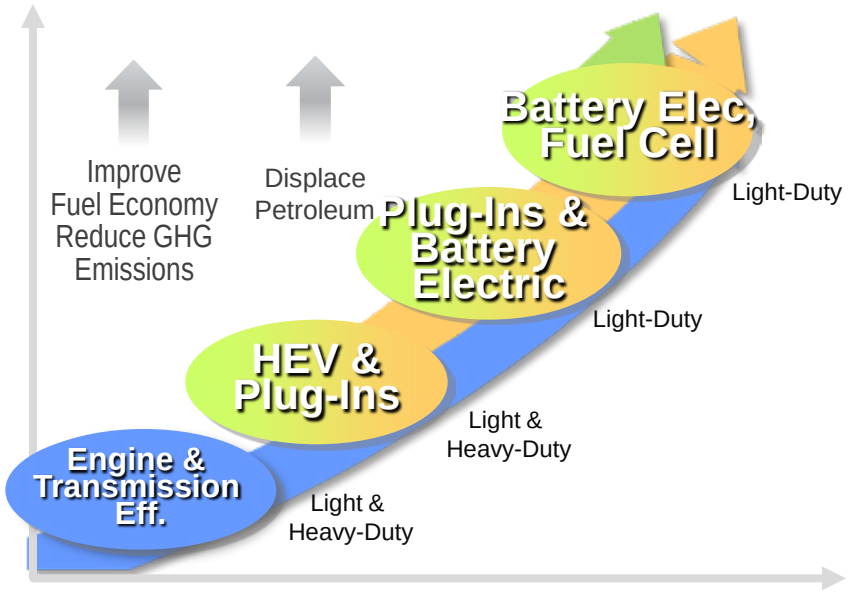
Well-to-Wheels Petroleum/GHG Reduction By Vehicle Type





Key Focus Areas

- Powertrain Electrification
- Improved Efficiency of Engines
- Lightweighting to Improve Efficiency
- Alternative Fuel Utilization

Mission, Goals, Targets & Budget

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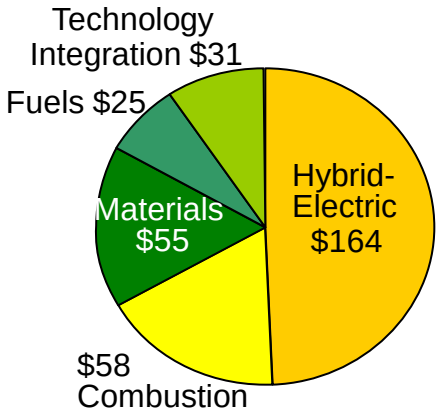
Mission: Develop clean highway transportation technologies to enable America to use less petroleum and lower greenhouse gas emissions

Key Administration Goals Relevant to Vehicle Technologies

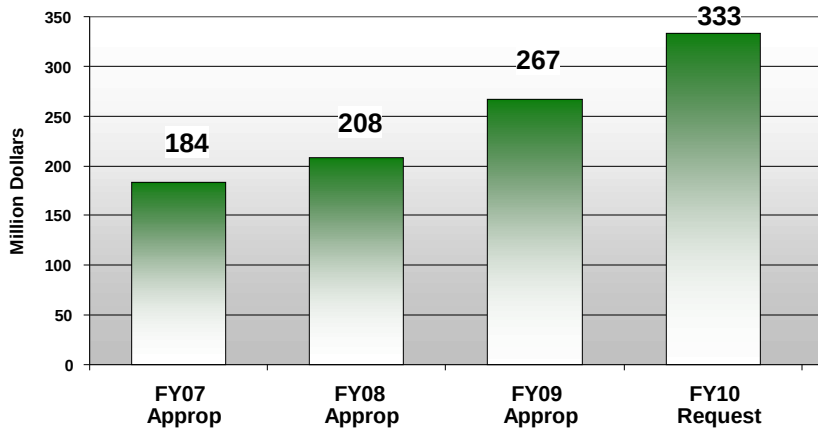
- One million PHEVs on the highway by 2015
- Reduce oil use in 10 years by an amount equivalent to today's imports from the Middle East and Venezuela (~3.5 mbpd).

Status	Target
Lower cost of electric-drive enables consumer adoption	
Electric drive cost at $19/kW power elec. and motor combined	Power Electronics: $12/kW; 15 yr life; 55 kW peak for 18 sec & 30 kW constant
Li-ion R&D: PHEV - < $1000/kWh – HEV cost at $625-850 for 100,000 units/year; life at 10-15 yr	Battery: PHEV – $300/kWh; 15 yr life; durability; 100 kWh/kg – HEV discharge power of 25 kW for 18 sec; storage at 300Wh; cost of $500 per sys
Efficiency reduces oil use and CO2 emissions	
Achieved engine efficiencies in lab testing of 43% for cars and 50% trucks	Combustion Efficiency: passenger vehicle up to 45% and commercial vehicles 55% at today's cost
Lightweighting improves efficiency of all vehicles	
Demonstrated 30% weight reduction of body and structure and lower cost carbon fiber	Material weight reductions up to 50% in body in white and component parts

FY10 Request $333.3M



Vehicle Technologies Budget Trend



Vehicle Electrification

President Obama announced $2.4 B in Grants to accelerate the manufacturing and deployment of the next generation of U.S. batteries and electric vehicles- August 5, 2009

Recovery Act will fund 48 new projects in advanced battery and electric drive components manufacturing and electric drive vehicle deployment in more than 20 states

Directly resulting in the creation **tens of thousands** of manufacturing jobs in the U.S. battery and auto industries

"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"

--President Obama

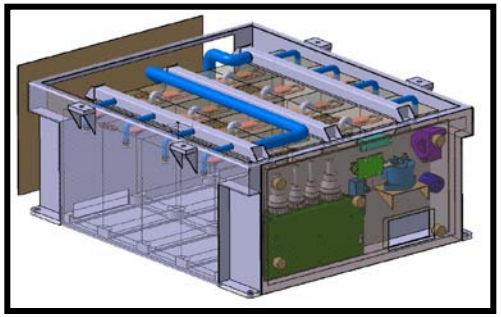
Hybrid-Electric Systems R&D

Vehicle and Systems Simulation and Testing

Complements hardware R&D activities through vehicle simulation and testing

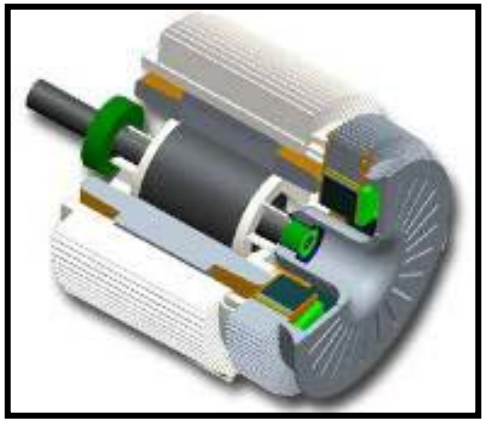
Energy Storage R&D

Battery technology R&D for hybrid-electric and plug-in hybrid-electric vehicles



Advanced Power Electronics and Electric Motors R&D

R&D for electric and electronic devices needed for drivetrain electrification



Energy Storage R&D Program Activities

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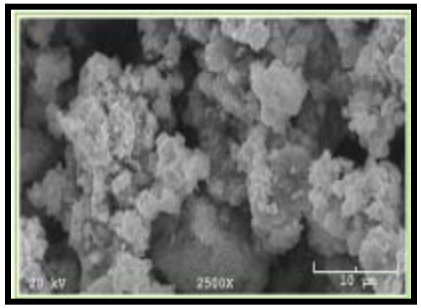
Advanced Materials Research → **High Energy & High Power Cell R&D** → **Full System Development and Testing** → **Commercialization**



- High energy cathodes
- Alloy, Lithium anodes
- High voltage electrolytes
- Lithium air couples

- High rate electrodes
- High energy couples
- Fabrication of high E cells
- Ultracapacitor carbons

- Hybrid Electric Vehicle (HEV) systems
- 10 and 40 mile Plug-in HEV systems
- Advanced lead-acid
- Ultracapacitors

The Energy Storage effort is engaged in a wide range of topics, from fundamental materials work through battery development and testing

PHEV Battery Targets & Challenges

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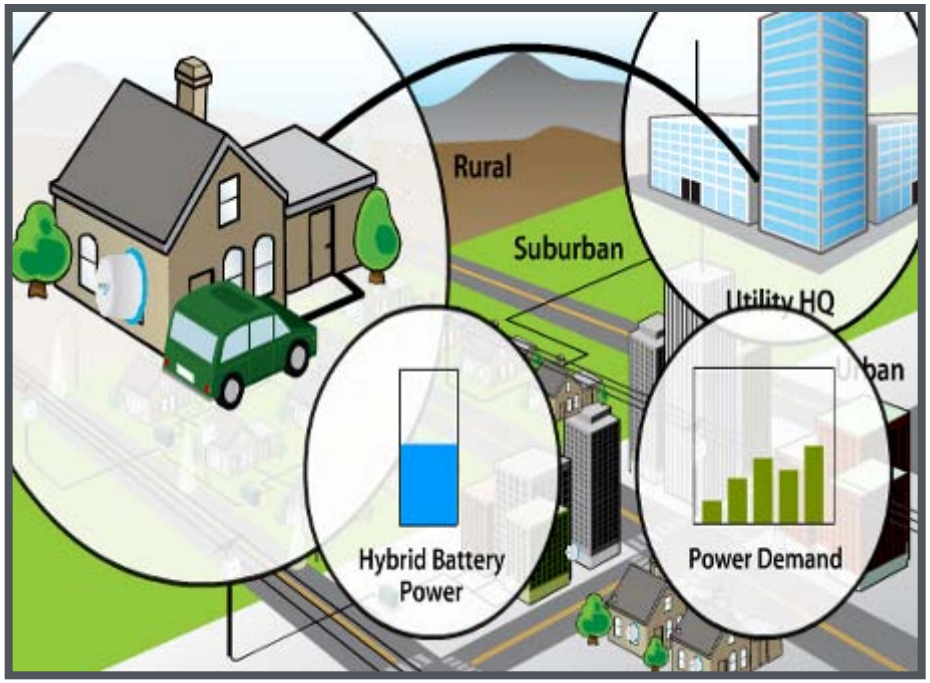
Battery Attribute	Current Status	Goals	
		2012	2014
Available Energy	3.4 kWh	3.4 kWh (10 mile)	11.6 kWh (40 mile)
Cost	$800^{+}/kWh	$500/kWh	$300/kWh
Cycle Life (EV Cycles)	1,000^{+}	5,000	3000-5000
Cycle Life (HEV Cycles)	300,000	300,000	200,000-300,000
Calendar Life	3^{+} years	10^{+} years	10^{+} years
System Weight	80 kg	60 kg	120 kg
System Volume	70 liters	40 liters	80 liters

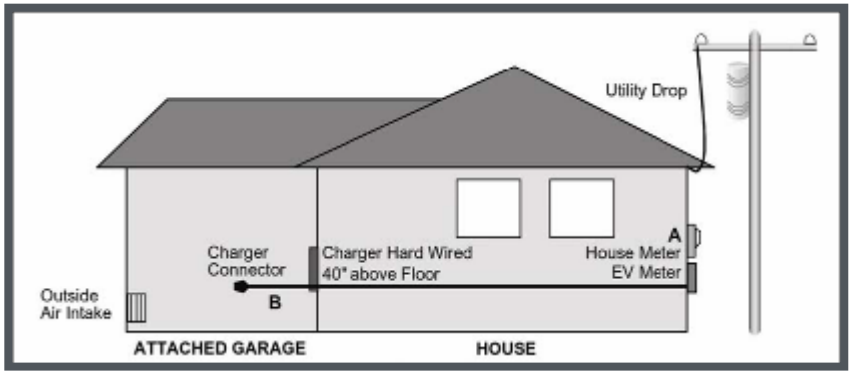
Key Challenges

- Weight and volume for the PHEV-40
- Extending life (while operating in 2 discharge modes)
- Reducing cost

Vehicle Infrastructure Electrification

- Initial results of Generation Capacity Study imply millions of PHEVs can be supported by existing generation
- Distribution network and charging options and availability being studied
- On-board and off-board charger R&D underway
- “Smart” grid and charging technologies are critical for high volume deployment





Tax Incentives

- **$14.4B in total**
- **$2B Plug-in Vehicle Tax Credits**
  - $2,500 to $7,500, based on battery size (4 kWh-16 kWh), for electric-drive vehicles (EVs and PHEVs) sold after 12/31/08
- **10% credit for low-speed electrified vehicles (Neighborhood Electric Vehicles), up to $2,500 ($25,000 SRP) until 12/31/11**
- **10% credit for plug-in conversions up to $4,000 ($40,000 conversion value), tax credit also available until 12/31/11**
  - Applies to both PHEV conversions and IC engine to EV conversions
- **$54 million for tax credits on alternative refueling property (including EV/PHEV charging)**

Contact Information

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

www.vehicles.energy.gov

Patrick Davis, Program Manager
202-586-8055
patrick.davis@ee.doe.gov