

Technology Advancement and Infrastructure Development Panel

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy



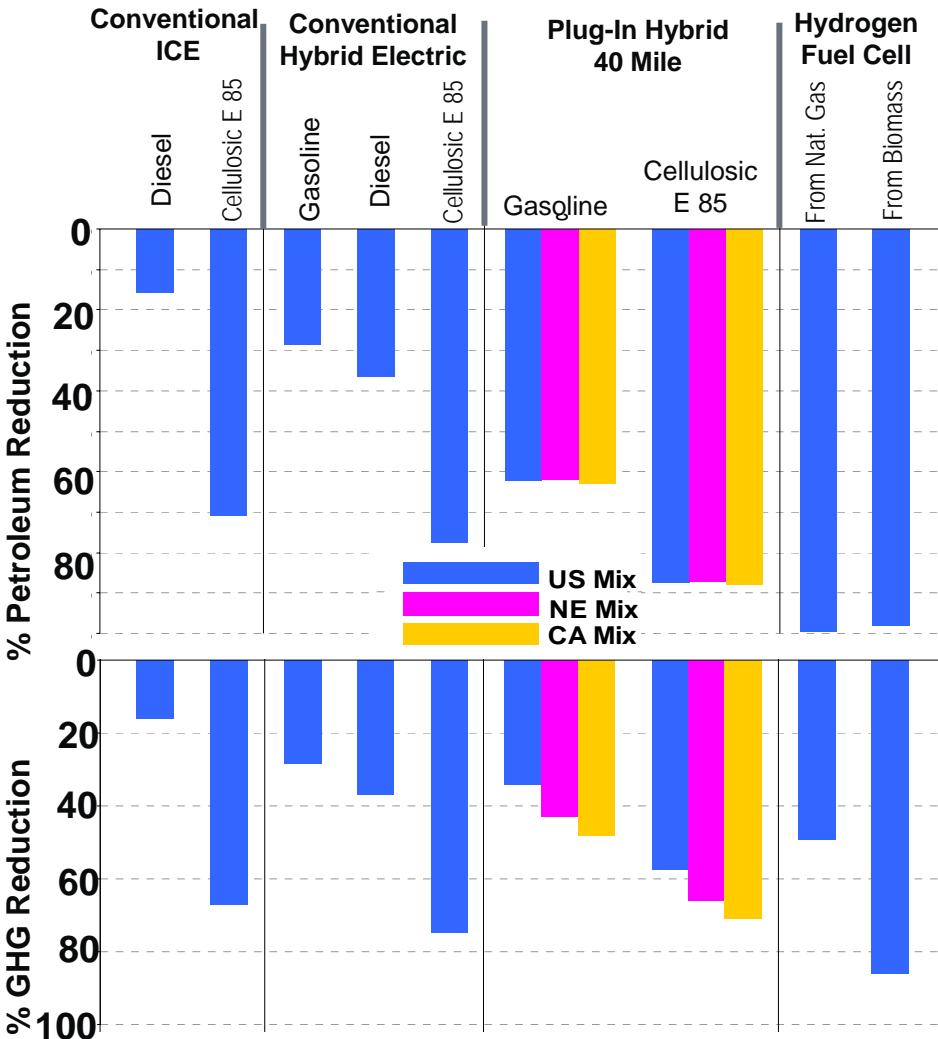
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September 29, 2009

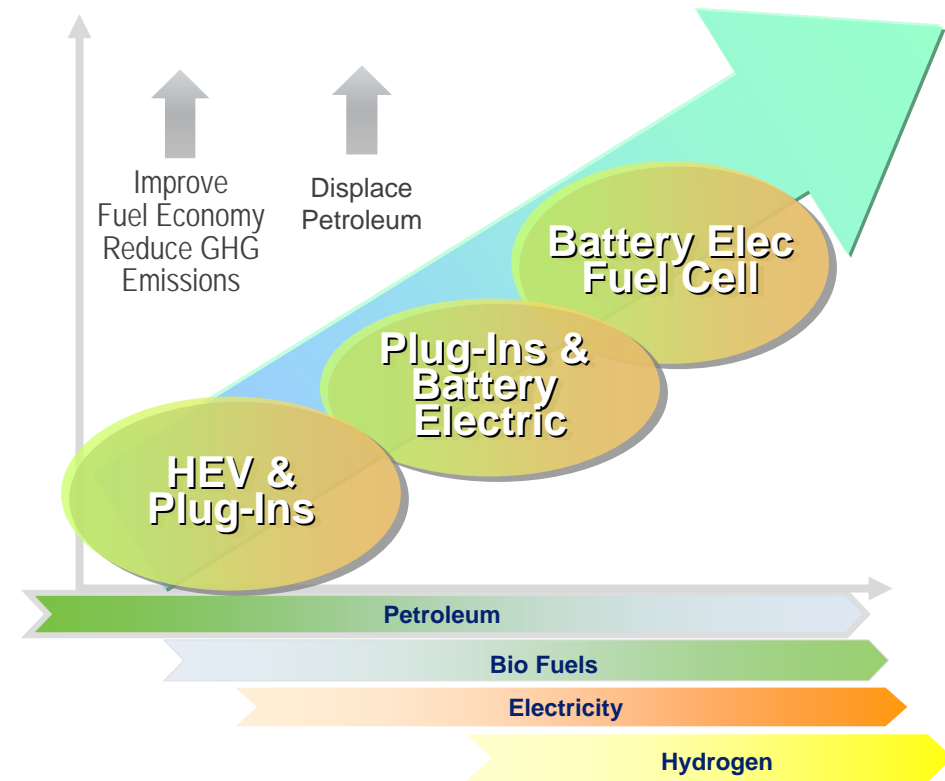
U.S. China Electric Vehicles
Forum

Vehicle Electrification is Key to Reducing Petroleum Dependency and Greenhouse Gas Emissions

Well-to-Wheels Petroleum/GHG Reduction



Vehicle Electrification Progression



Administration Goal: 1 Million PHEVs by 2015

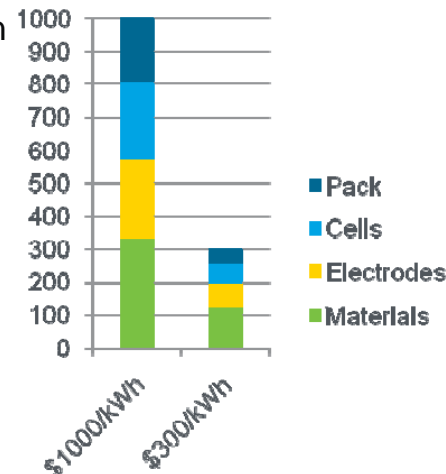
**Annual vehicle battery R&D spending:
\$80M**

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

Recovery Act will fund multiple projects in advanced battery components manufacturing

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



Status and Targets

2009 Status

Status: \$8000-\$12,000 for a PHEV 40-mile range battery

Status: Current cost of the electric traction system is \$40/kW

Targets

2014 PHEV: Battery that has a 40-mile all-electric range and cost \$3,400

2015 PEEM: Cost for electric traction system no greater than \$12/kW peak by 2015

Battery Chemistry Comparison

Lithium Ion Chemistry	Type 1	Type 2	Type 3	Type 4
Life	😊	😞	😊	😊
Power	😊	😊	😊	😊
Energy	😊	😊	😊	😞
Abuse tolerance	😞	😊	😊	😊
Materials cost	😊	😊	😞	😊

Power Electronics – *Power inverters and converters for electric drivetrains*

- Wide Band Gap semiconductors for increased efficiency
- New device packaging and topologies to minimize cost
- Low cost, high temperature capacitors

Traction Drive Systems – Combined stand-alone drive systems enable all-electric operation for plug-in hybrids and fuel cell vehicles



Electric Motors – Hybrid and Plug-in Hybrid capable designs

- Novel motor concepts to reduce cost
- Research to develop low cost, high performance magnetic materials

Thermal Control – Improving heat transfer and reliability evaluation

- Enables smaller devices through more aggressive cooling technologies
- Predictive thermal stress and reliability models identify design issues



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