2008 DOE Annual Merit Review
Hybrid and Electric Systems and Materials Technologies Plenary Session Overview

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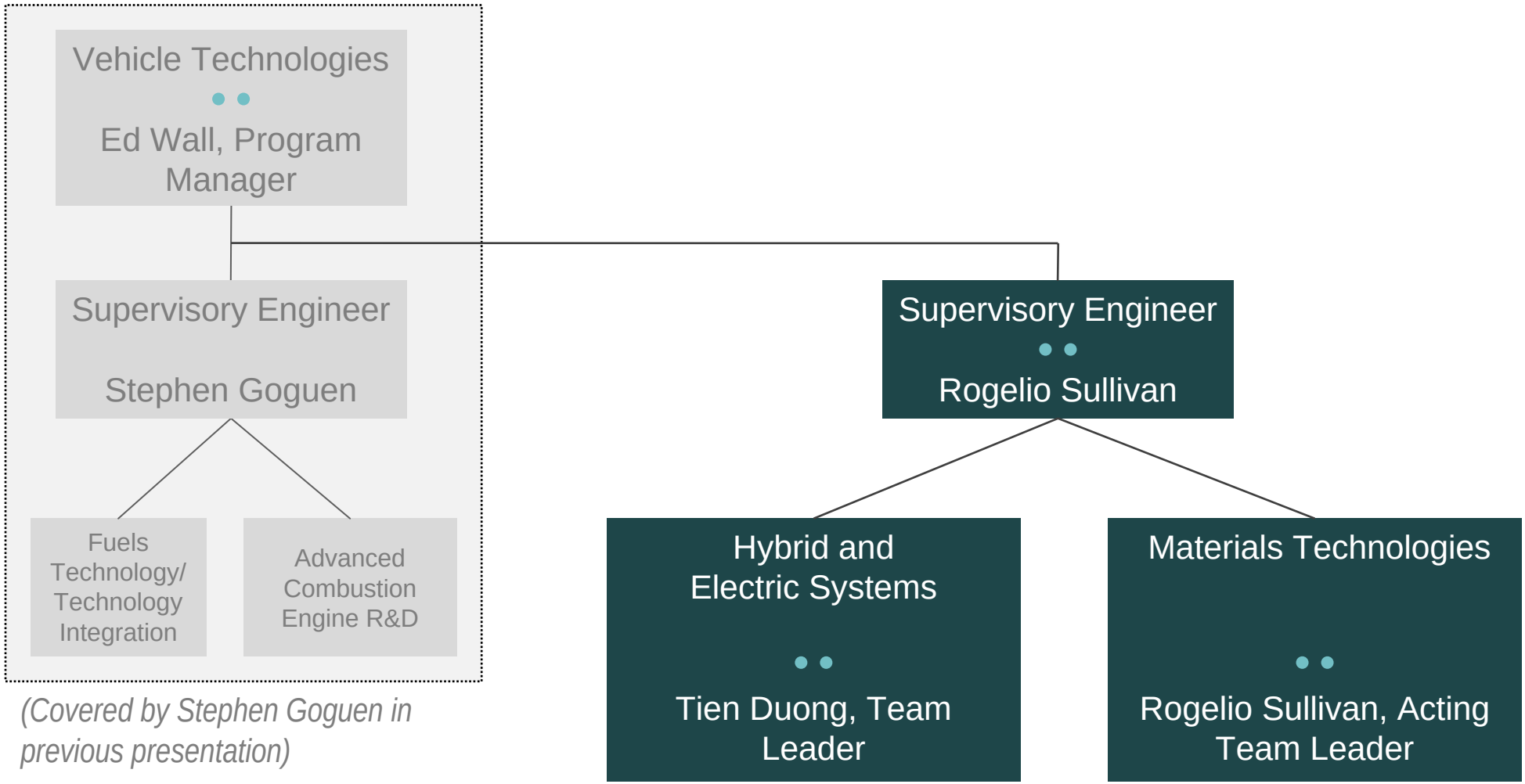
U.S. Department of Energy
Vehicle Technologies Program
February 25, 2008

Program Structure



(Covered by Stephen Goguen in previous presentation)

Program Elements

- Hybrid and Electric Systems
  - Electrochemical Energy Storage
  - Power Electronics and Electric Machines
  - Vehicle Systems Simulation and Test

- Materials Technologies
  - Lightweight Materials
  - Propulsion Materials
  - High Temperature Materials Laboratory (HTML)

Technology Overview – Hybrid Electric Systems

- Energy Storage R&D
  - Exploratory Research
  - Applied Research
  - Battery Development
- Power Electronics / Electric Machines
  - Electrical Machines
  - Power Electronics
  - Systems Integration
  - Thermal Control Research
- Vehicle Systems
  - Vehicle Modeling and Simulation
  - Vehicle Testing and Evaluation
  - Propulsion and Ancillary Systems
  - Vehicle technology demonstration

Technology Overview – Materials Technologies

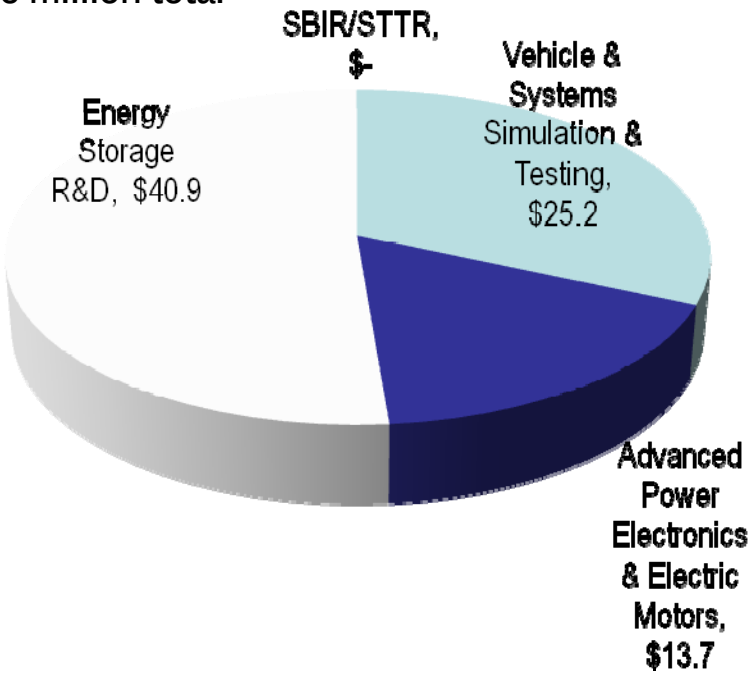
- Lightweight Materials
  - Metals processing
  - Composites development & processing
  - Joining
  - Recycling
  - Non-destructive evaluation
- Propulsion Materials
  - Materials by Design
  - Materials for Electric Drive Systems
  - Materials for High Efficiency Engines

ANL Plastics Recovery Experimental Facility

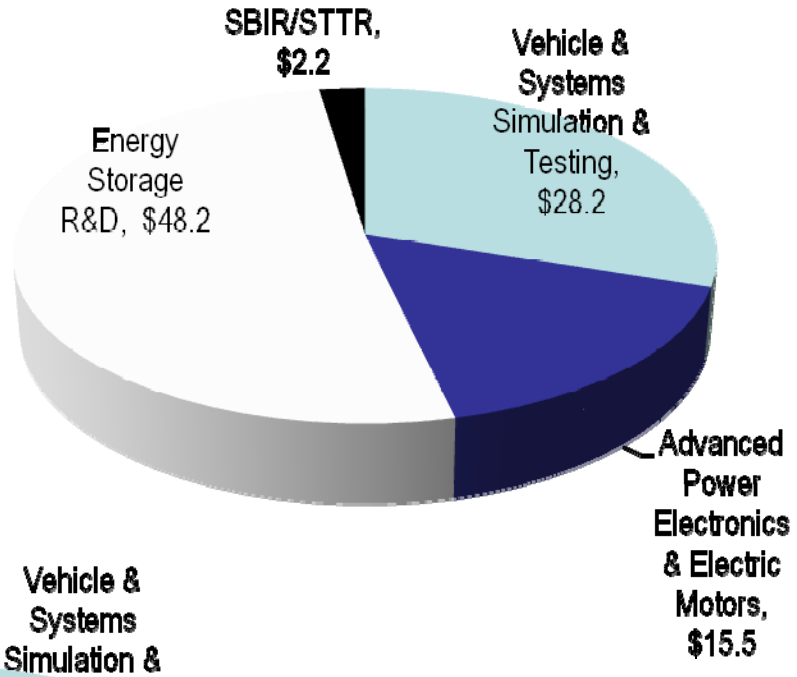
ORNL Research P4 Machine

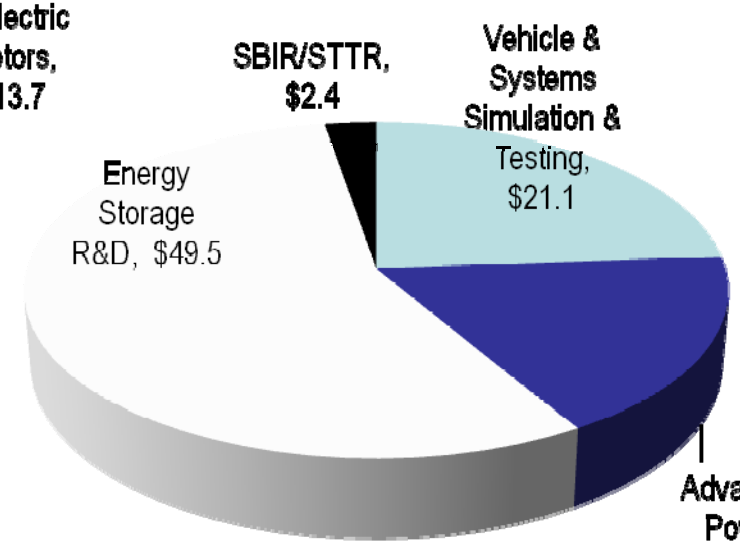
Budget Summary – Hybrid and Electric Systems

FY 2007 Appropriation
$79.8 million total



FY 2008 Appropriation
$94.1 million total

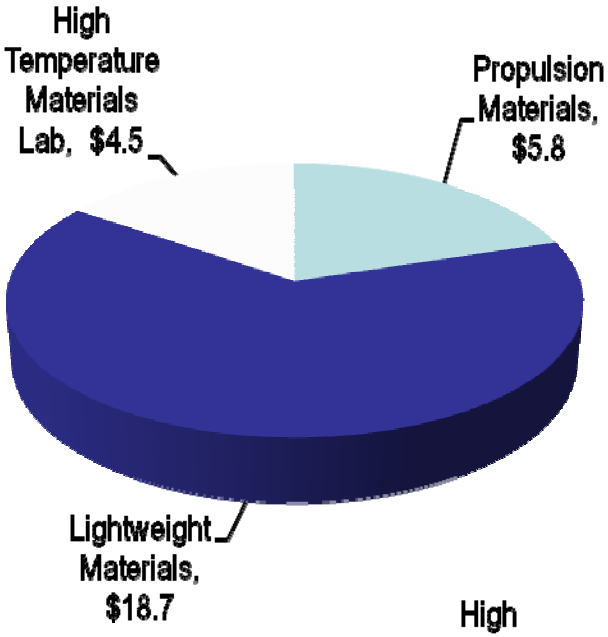




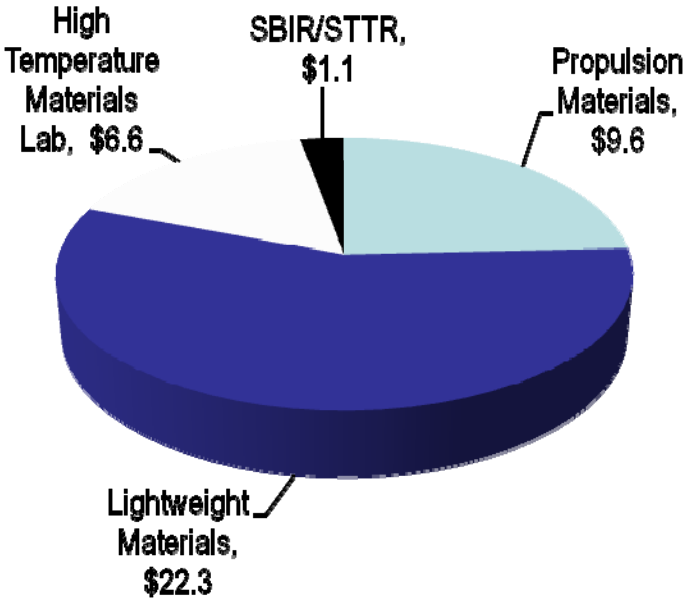
FY 2009 Request
$88.6 million total

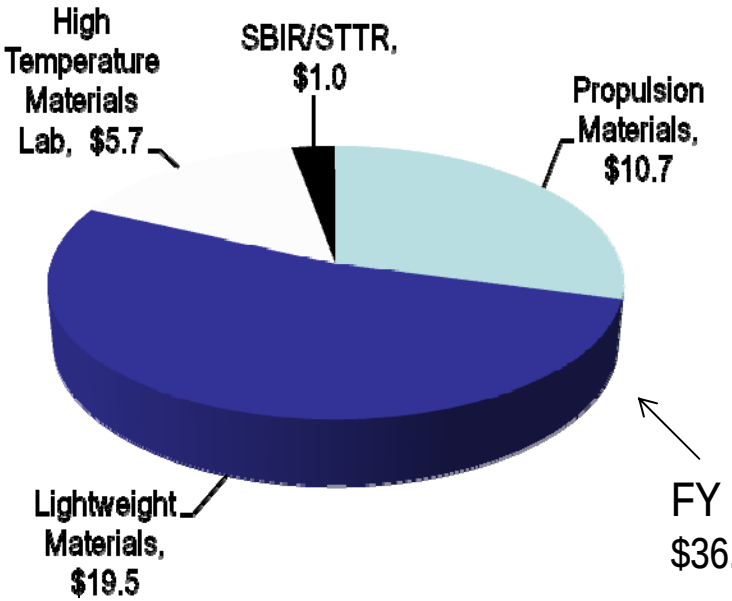
Budget Summary – Materials Technologies

FY 2007 Appropriation
$29.0 million total



FY 2008 Appropriation
$39.7 million total

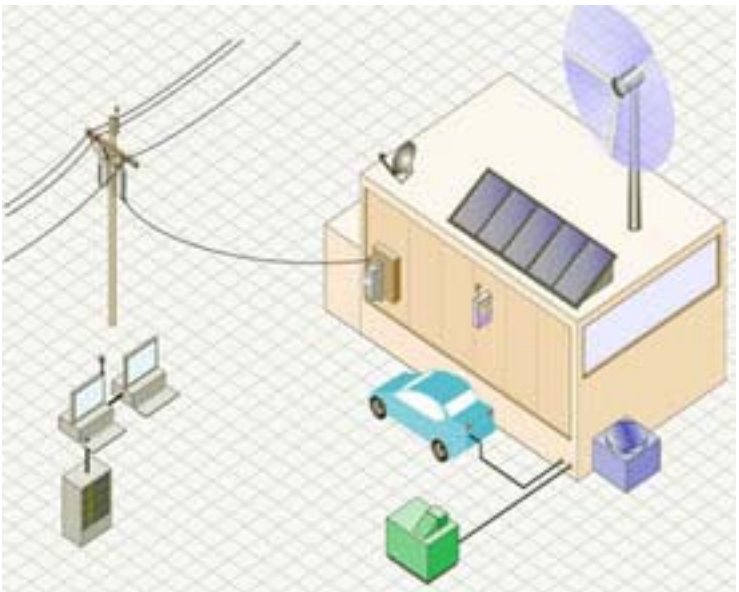




FY 2009 Request
$36.9 million total

Program Priorities – Hybrid and Electric Systems - 1

- Plug-in Hybrid Electric Vehicles (PHEVs) provide many benefit for the transportation sector including:
  - Reduced oil consumption
  - Reduced Green House Gas (GHG) emissions
  - Improved urban air quality
  - Reduced energy costs to consumers
  - Increased transportation fuel diversity
  - Increased operational efficiency of electric utility grid
  - Synergies with renewables, specifically wind and solar

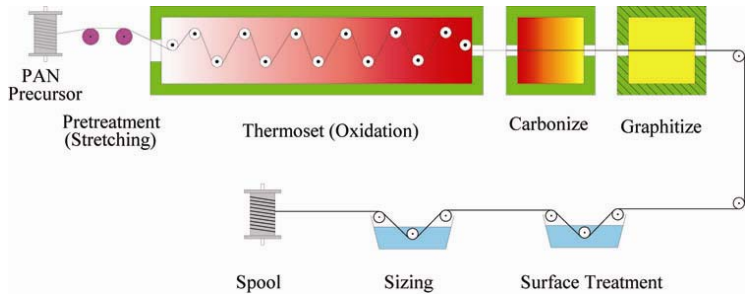


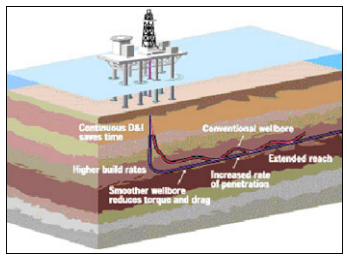
Program Priorities – Hybrid Electric Systems - 2

- Energy storage development for electric drive vehicles
  - Potential use as energy storage for variable generation technologies such as wind, solar and other renewable stationary power technologies

Program Priorities – Materials Technologies

- Achieve 50% reduction in the weight of the body and chassis
  - Emphasis is on the development of low cost, high performance composites for significant impact on fuel economy in the mid term
  - Carbon fiber composites can be used for high stiffness structural applications
    - High cost remains the largest (but not the only) hurdle to production implementation as a vehicle structural material
  - Synergies with other programs include:
    - Wind – turbine blades
    - Fossil – oil exploration
    - Hydrogen – high pressure storage vessels
    - Civil infrastructure, consumer goods, construction, other transportation vehicles



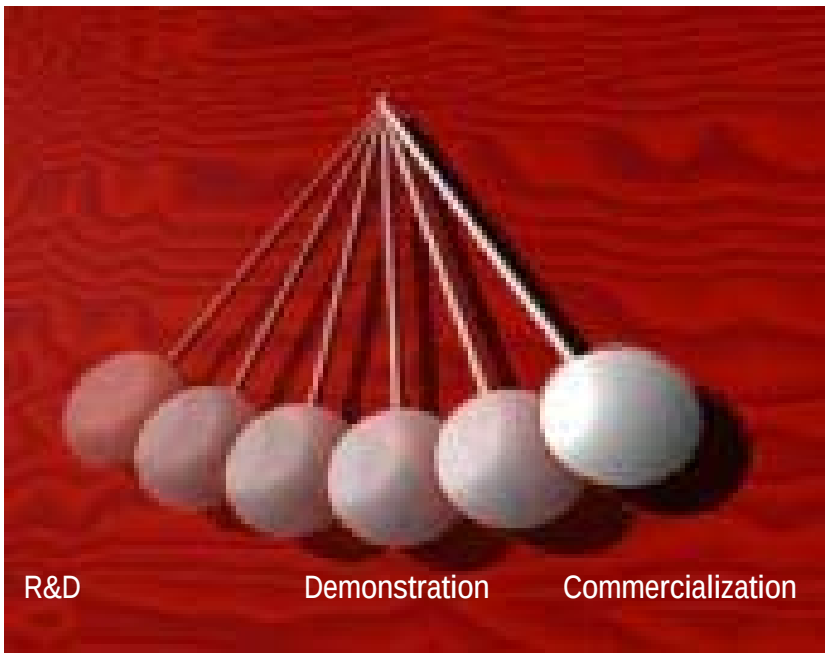


Program Progress

- Recent contract awards include:
  - Power Electronic and Electric Machines – 5 contracts – Fall 2007
  - Li Ion Batteries for PHEVs – 5 contracts – Fall 2007
  - PHEV Demonstration – First submission opportunity recently closed – February 2008
- New Funding Opportunity Announcement planned - March 2008
  - Battery Materials and Manufacturing
  - Truck trailer aerodynamics
  - Thermoelectric materials

Program Emphasis Changes

- Program emphasis has shifted toward greater emphasis from R&D to commercialization of technology
- Program priorities have also changed as a result of this new emphasis
- Reduction in heavy vehicle programs (trucks, rail, off-highway)
- Congressionally Directed Activities



Program Emphasis Changes

- Testimony of Energy Secretary Samuel Bodman, United States Senate Committee on Energy and Natural Resources, February 7, 2007

Vehicles Technologies and FreedomCAR. This year's request emphasizes plug-in hybrid vehicle component technologies by increasing the requested research support to $81 million. These technologies offer the potential to make significant additional improvements in petroleum reduction beyond that achievable with standard hybrid configurations. By utilizing energy drawn from the nation's electricity grid at off-peak times to charge high energy batteries, these technologies will be able to operate in an electric vehicle mode for expanded distances, potentially meeting most drivers' needs for commuting and short distance driving. , too urgent, and too important to be solved by any one person or any one sector.

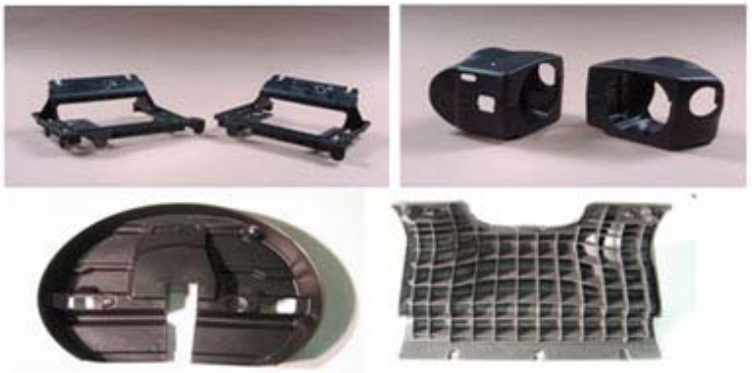
The Energy Policy Act of 2005 authorized the establishment of a new Loan Guarantee Program. This budget request includes $8.4 million to operate a Loan Guarantee Office. This program will centralize loan guarantee services for the Department to ensure all processes and criteria are applied uniformly in accordance with established requirements, procedures, guidelines, regulations and manage the assessment of all loan guarantee applications submitted to the Department in compliance with Title XVII of the Energy Policy Act of 2005. Section 1703 of that Act authorizes the Department to provide loan guarantees for renewable energy systems, advanced nuclear facilities, coal gasification, carbon sequestration, energy efficiency, and many other types of projects. The budget proposes an FY 2008 loan volume limitation of $9 billion. Of this amount, the Department will seek to guarantee approximately $4 billion in loans for central power generation facilities (for example, nuclear facilities or carbon sequestration optimized coal power plants); $4 billion in loans for projects that promote biofuels and clean transportation fuels; and $1 billion in loans for projects using new technologies for electric transmission facilities or renewable power generation systems.

Program Emphasis Changes – Example 1

- Demonstrate that satisfactory carbon fiber can be made from textile precursors
- PHEV Value Proposition and grid integration studies
  - Alternative battery ownership scenarios
  - Utility costs and value streams
  - Business case analysis
- PHEV demonstration in parallel with battery research

Program Emphasis Changes – Examples 2

- Loan Guarantee Authority has been given to DOE
  - Can accelerate the commercialization of high risk technologies
  - Potential topics include hybrid electric vehicle battery systems, carbon fiber production



Auto parts made with 100% recycled polyolefins recovered from “post-shred” residue

ANL Physical Separation Experimental Plant

Commercialization Efforts – Materials Technologies

- Partnering with industry to develop near/mid term capabilities for the production of affordable carbon fiber for vehicles.
- Partnering with industry to commercialize proprietary process for extracting valuable materials from automotive shredder residue
- Partnering with primary metals suppliers/fabricators to develop design data and property databases that can enable new applications.
- Examining other successful of “market transformation” models for applicability to materials.

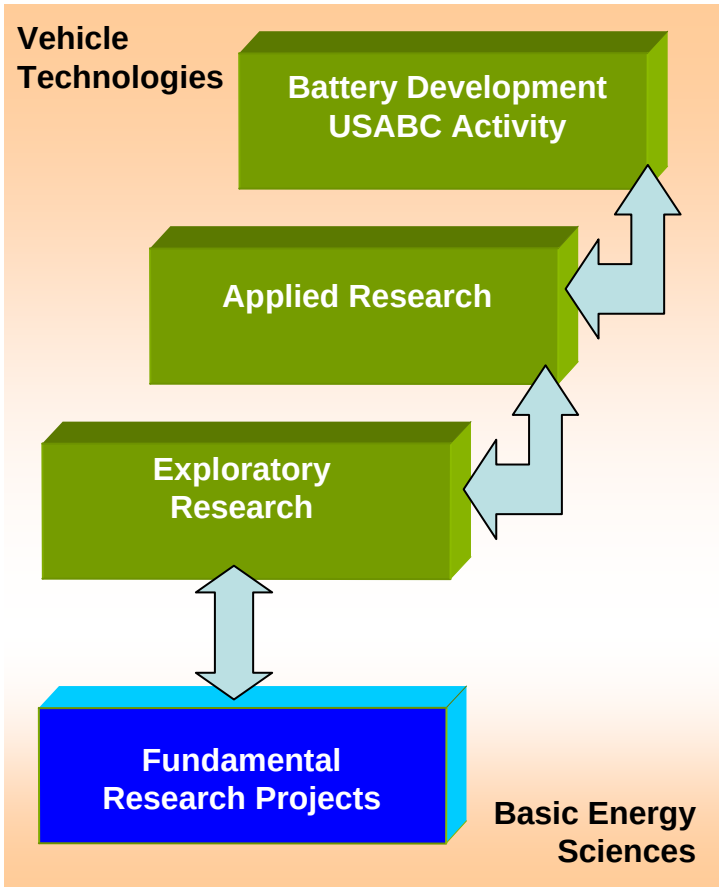
Success – Materials Technologies

- CF8C-Plus
  - New high strength, ductile, high temperature cast stainless steel material with multiple applications
  - 2003 R&D100 Award winner
  - Currently utilized in the Caterpillar Regeneration System (CRS) for all highway HD diesel truck engines

- HTML
  - C3 International LLC – nano-coating technology company
  - Developed technology with HTML to permit the creation of thin layers of highly wear-resistant materials
  - Myriad industrial applications identified

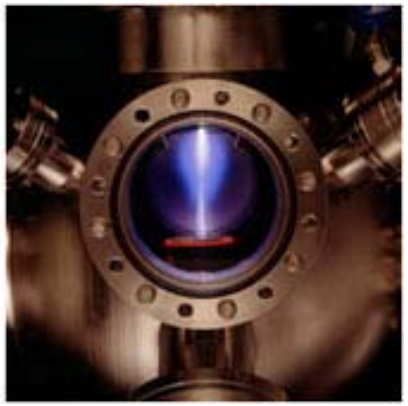
Future Program Directions

- Hybrid and Electric Systems
  - Additional systems analysis & integration
  - Expand research in battery chemistries beyond Li Ion
- Materials Technologies
  - Address and resolve multi-material vehicle manufacturing
  - Increasing ties with HTML to accelerated research in core areas



Questions?



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