Lightweight Materials

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Materials R&D Team	
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What are the top 5 future Service/Agency needs (in 20 to 25 years)?

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

Key Administration Goals Relevant to Vehicle Technologies

- Reduce green house gas emissions by 50% in 2030 (from 2005 baseline) and by 80% in 2050

What does this really mean?

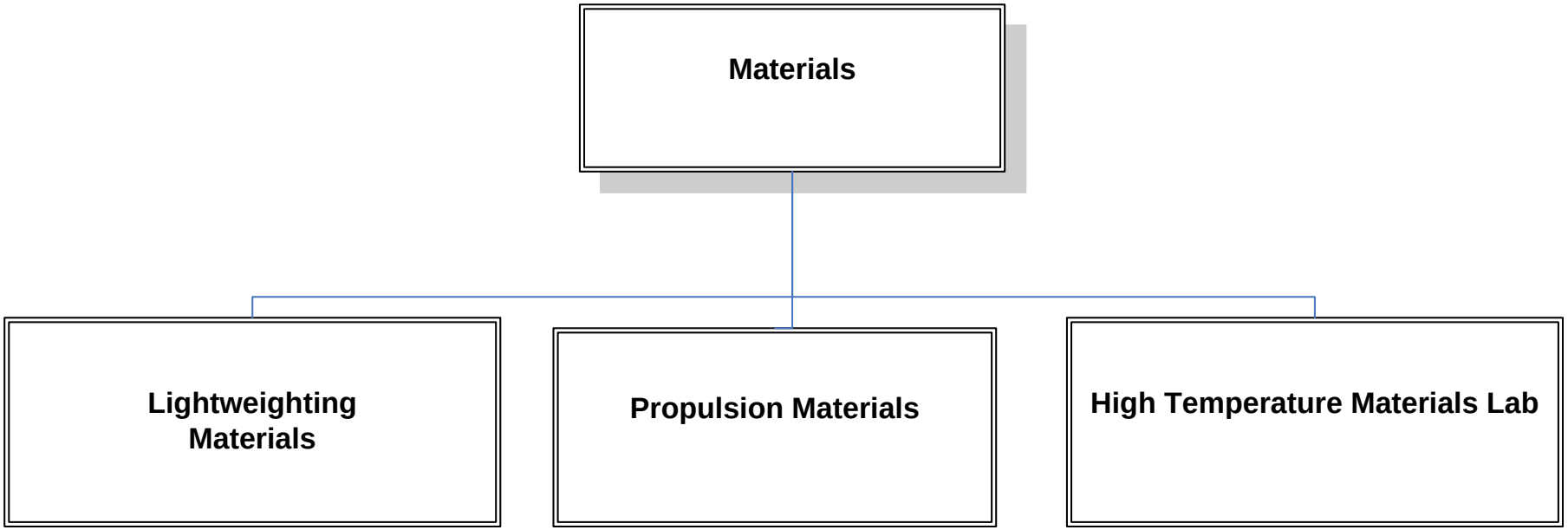
- In 2050 we need 50mpg vehicles with 45% miles electrified
- If we only achieve 45mpg with 0% electrified miles then reduce the total number of miles traveled by 70%

Materials Technologies: FY 2011

By 2015, validate (to within 10% uncertainty) the cost-effective reduction of the weight of passenger vehicle body and chassis systems by 50% with recyclability comparable to 2002 vehicles

Goal: **Develop high performance cost-effective materials that enable high efficiency propulsion systems that reduce energy consumption by focusing on key technical deficiencies in materials performance that limit expanded capabilities of advanced combustion engines, electric-drive systems, and utilization of renewable fuels**

Goal: **Provide state of the art characterization facility to provide enabling and unique materials characterization that supports materials challenges relevant to the Vehicles Technologies Program**



Materials Budget History

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

Budget area	FY'10 $K	FY'11 $K (CR)	FY'12 $K
Lightweighting Materials	30,652	29,619	26,244
Propulsion Materials	12,989	12,962	9,720
HTML	5,662	5,650	972
SBIR/STTR	0*	1,389	1,064
Total	49,303*	49,620	38,000

* SBIR/STTR transferred in FY2010 was $1,268 for SBIR and $152,169 for STTR

Lightweighting

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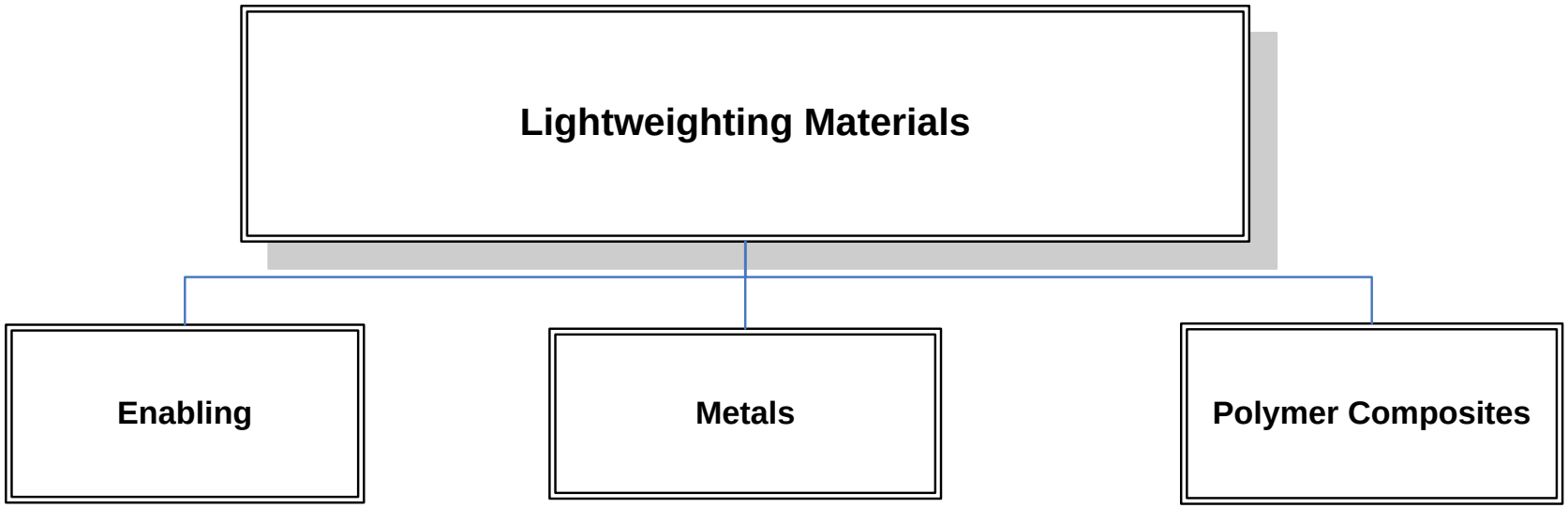

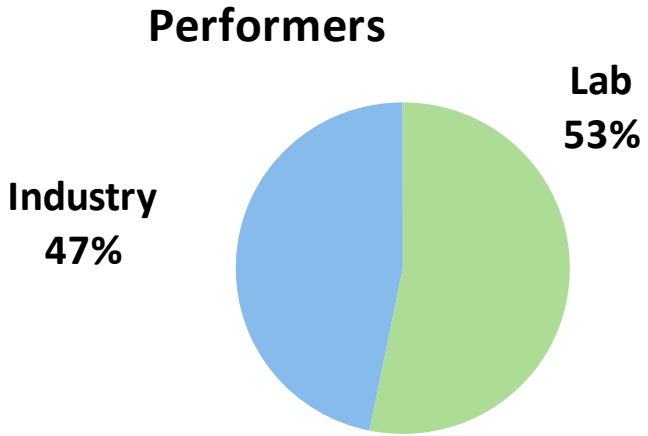

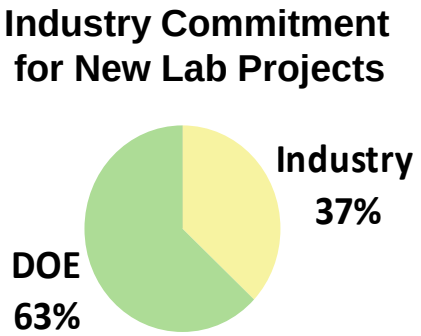

Lightweighting: USAMP

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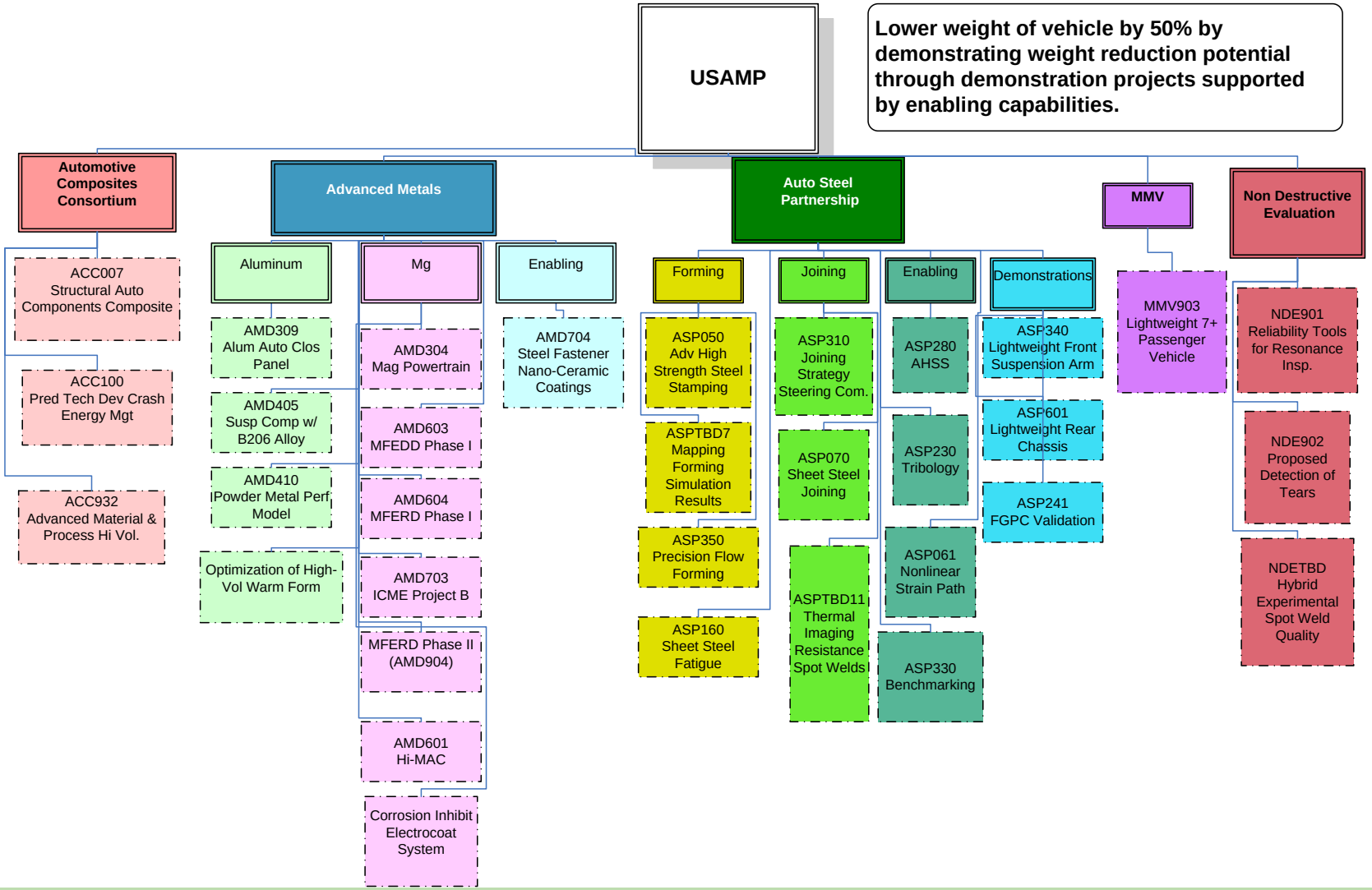

Lightweighting: Enabling

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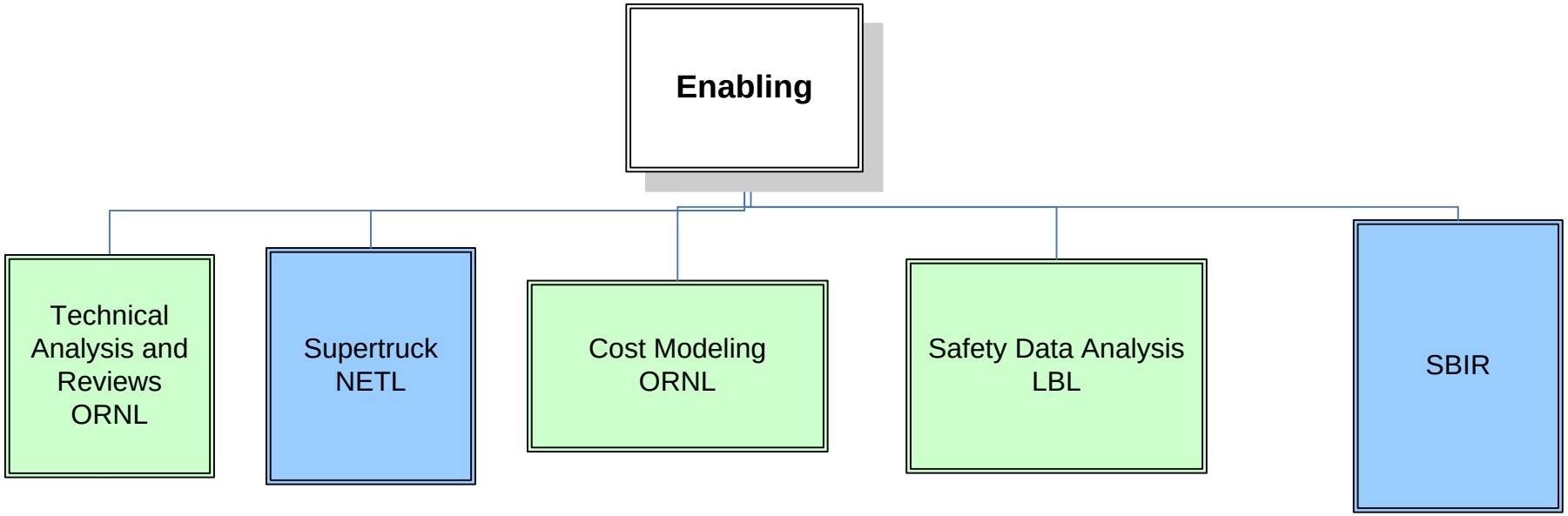
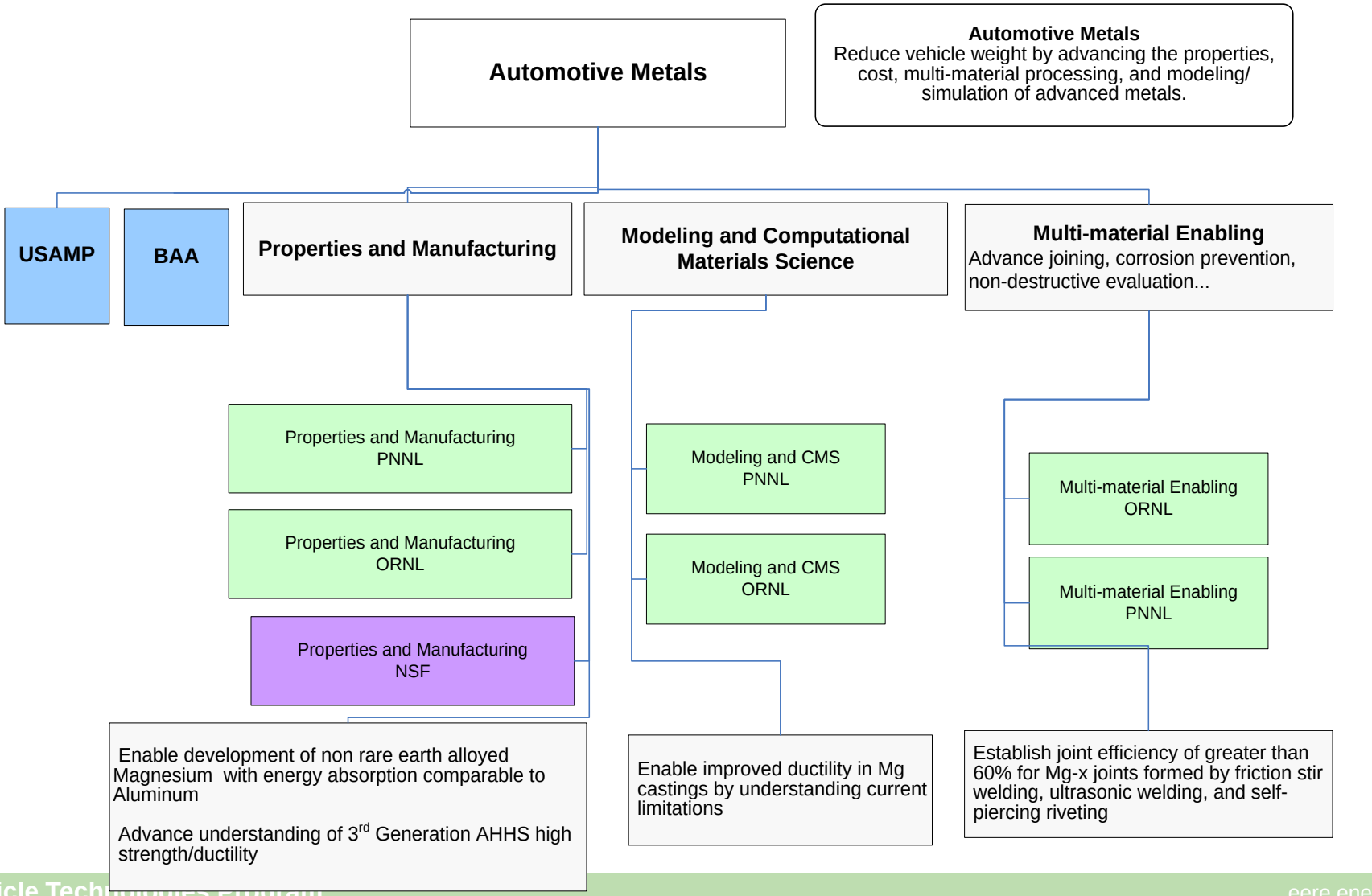


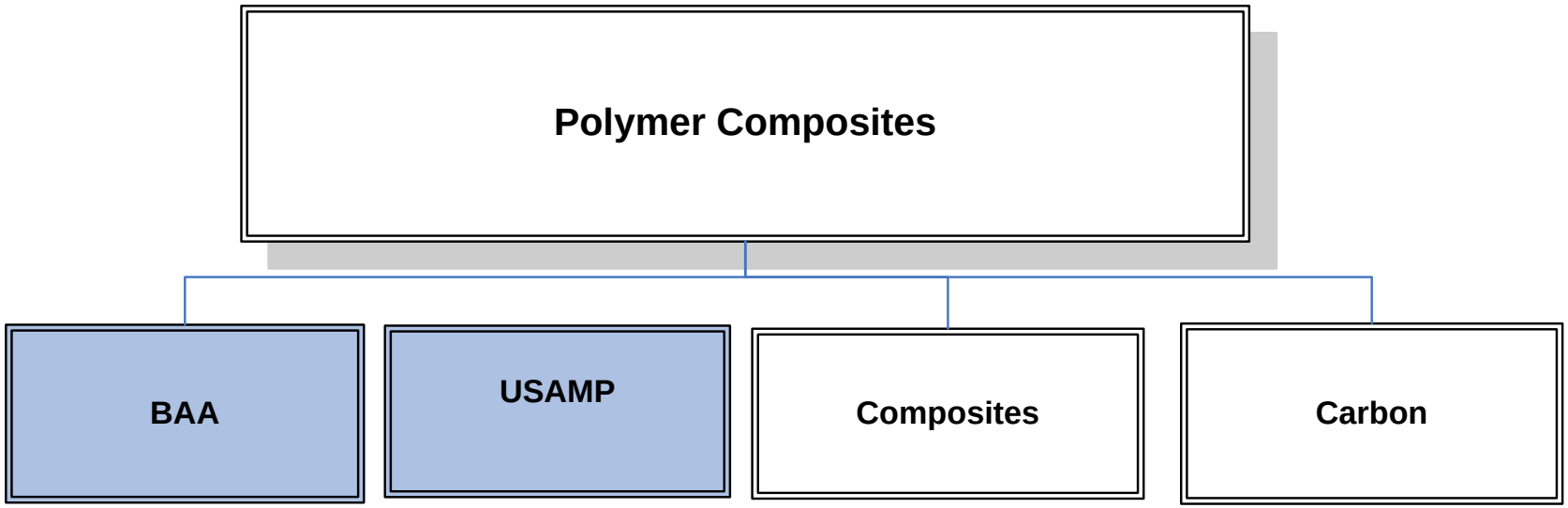
Lightweighting: Automotive Metals

By 2015, validate (to within 10% uncertainty) the cost-effective reduction of the weight of passenger vehicle body and chassis systems by 50% with recyclability comparable to 2002 vehicles



Lightweighting: Polymer Composites

By 2015, validate (to within 10% uncertainty) the cost-effective reduction of the weight of passenger vehicle body and chassis systems by 50% with recyclability comparable to 2002 vehicles



Lightweighting: Carbon Fiber

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Low Cost Carbon Fiber Production
ORNL

Goal: Lower weight potential of vehicle by reducing the cost of carbon fiber to ~$5/lb.

<u>Low Cost Precursors</u>
Carbon Fiber from Polyolefins (higher performance intermediate to long term term)
Complete initial evaluation of PAN-MA produced in a textile facility for higher strength, lower cost applications. (short term)
Minimum target properties are 400 KSI strength and 30 MSI modulus

Speed Up and Increase Capacity for Oxidation
Advanced Oxidation of CF Precursors
Demonstrate the ability to oxidize multiple large tows in ~1/2 of conventional residence time

Speed Up Conversion
Define the MAP operational capabilities and limitations necessary to scale up

Conventional Interfacial Optimization
Ensure that fiber matrix adhesion is sufficient to validate low cost carbon fiber in composites for future demonstration projects

Lightweighting: Polymer Composites

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Lower weight potential of vehicles by developing enabling tools by:

- **Lowering manufacturing cost through enabling tools**
- **Speeding up product development cycle time**

Polymer Composites

PNNL
Predictive Modeling

ORNL
Predictive Modeling and Adhesion Study

Predictive Modeling: validate fiber length and distribution and predicted mechanical properties within 10% for samples made from mold of intermediate complexity

Composite Underbody Attachment

www.vehicles.energy.gov

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