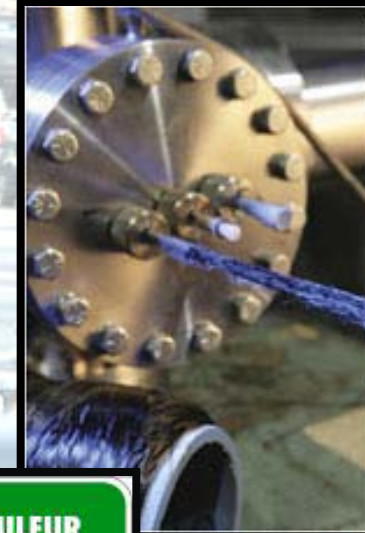


Vehicles Technology Program Annual Merit Review – Propulsion Materials

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy



**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.

**AMERICA'S FIRST
BIOFUELS CORRIDOR**



Jerry Gibbs
Technology Development Manager
Propulsion Materials
Vehicle Technologies Program

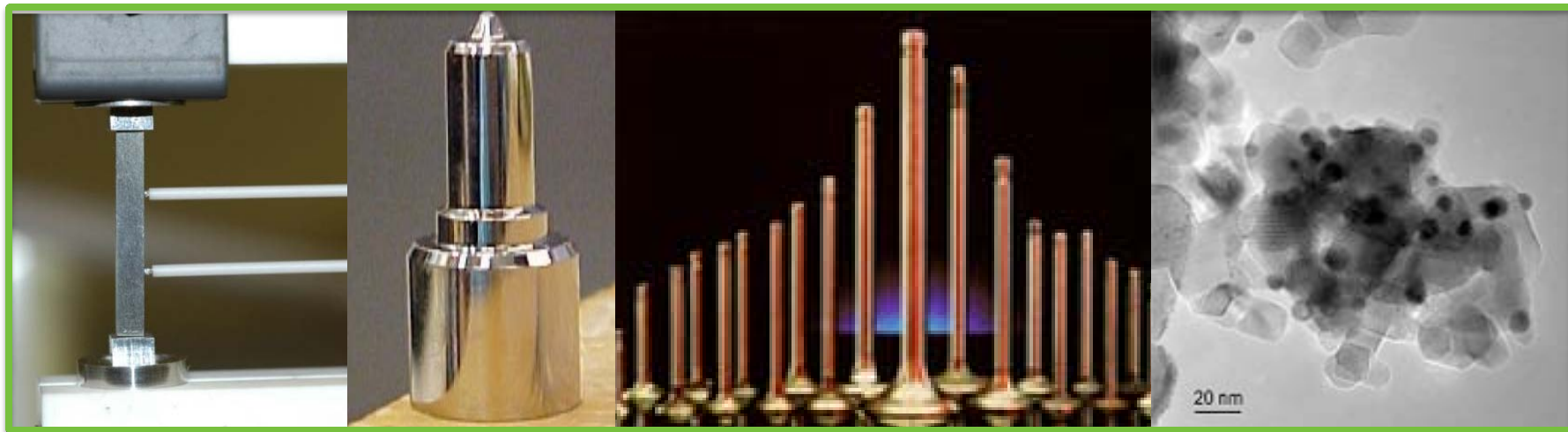
Lightweighting improves efficiency of all vehicles:

Reduce the weight of the vehicle by 50% in a cost effective way

Propulsion materials support the goal of achieving combustion efficiency:

Passenger vehicles up to 45% and commercial vehicles 55% at today's cost :

- ❑ ICE Requirements are demanding
 - High pressure fuel injection materials up to 45,000 psi for diesel engines
 - Peak cylinder pressure > 2,700 psi
- ❑ Increased need for Energy Recovery
 - Accelerate use of Thermoelectric devices
 - Increased use of boosting technologies
- ❑ Anticipate impacts of new fuel formulations



- Improve efficiency of advanced vehicles through innovative material solutions
- Critical enabler supporting Advanced Combustion, Thermoelectric, and Hybrid-Drive Systems
 - Materials compatibility for Alternative Fuels
 - Materials for high efficiency AF/SI Engines
 - Materials for high efficiency CIDI engines
 - Materials for HCCI / HECC engines
 - Thermoelectric materials
 - Materials for reliable high performance hybrid and EV drive systems

Propulsion Materials Activities

Materials for Combustion Systems /

High Efficiency Engines

Turbocharger, Valve train, Fuel Injection, Structural Components Head/Block, Sensors, Materials/Fuel Compatibility

Materials for Exhaust and Energy Recovery

DPFs, Catalysts, Thermoelectric Materials, Materials for high temperature structures

Materials for Electric and Hybrid Drive Systems

High Temperature Power Electronics Materials, Solder Joints, Materials/Coolant Compatibility, And Materials for Electric Drive Motors

Materials By Design

Materials Synthesis, Characterization, Multi-Scale Computer models, Testing Standards, and Coatings

VTP Team Collaborations

Advanced Combustion Engine

LD 45%e @ \$30/kW

**HD 55%e
Biofuels**

Hybrid Electric Systems

55kW @ \$12/kW

300Whr @ \$20/Whr

Fuels Technologies

Petroleum Displacement

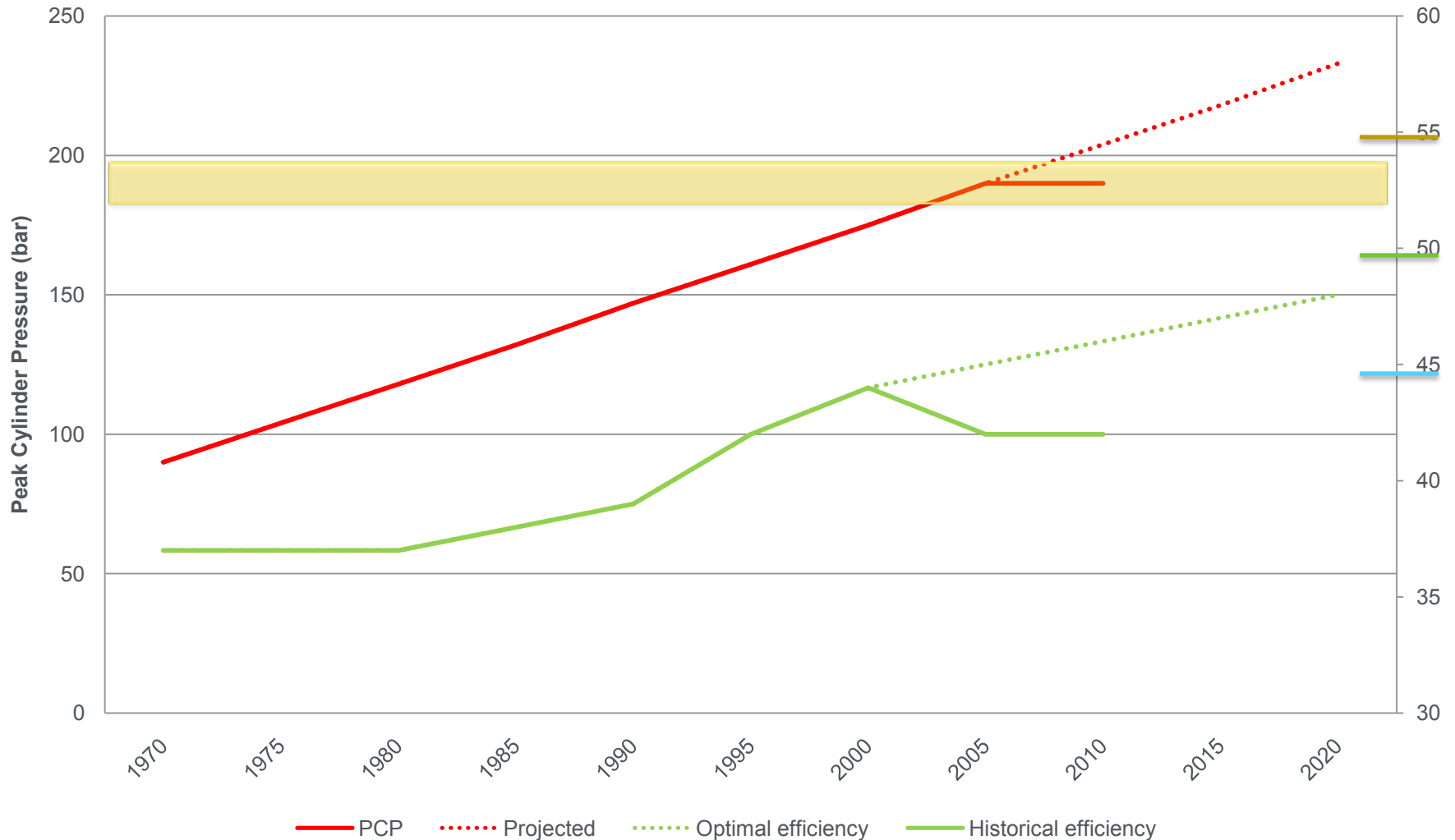
Weight Savings and Costs for Automotive Lightweighting Materials

<i>Lightweight Material</i>	<i>Material Replaced</i>	<i>Mass Reduction (%)</i>	<i>Relative Cost (per part)*</i>
High Strength Steel	Mild Steel	10 (25?)	1 (<?)
Aluminum (Al)	Steel, Cast Iron	40 - 60	1.3 - 2
Magnesium	Steel or Cast Iron	60 - 75	1.5 - 2.5
Magnesium	Aluminum	25 - 35	1 - 1.5
Glass FRP Composites	Steel	25 - 35	1 - 1.5
Carbon FRP Composites	Steel	50 - 60	2 - 10+
Al Matrix Composites	Steel or Cast Iron	50 - 65	1.5 - 3+
Titanium	Alloy Steel	40 - 55	1.5 - 10+
Stainless Steel	Carbon Steel	20 - 45	1.2 - 1.7

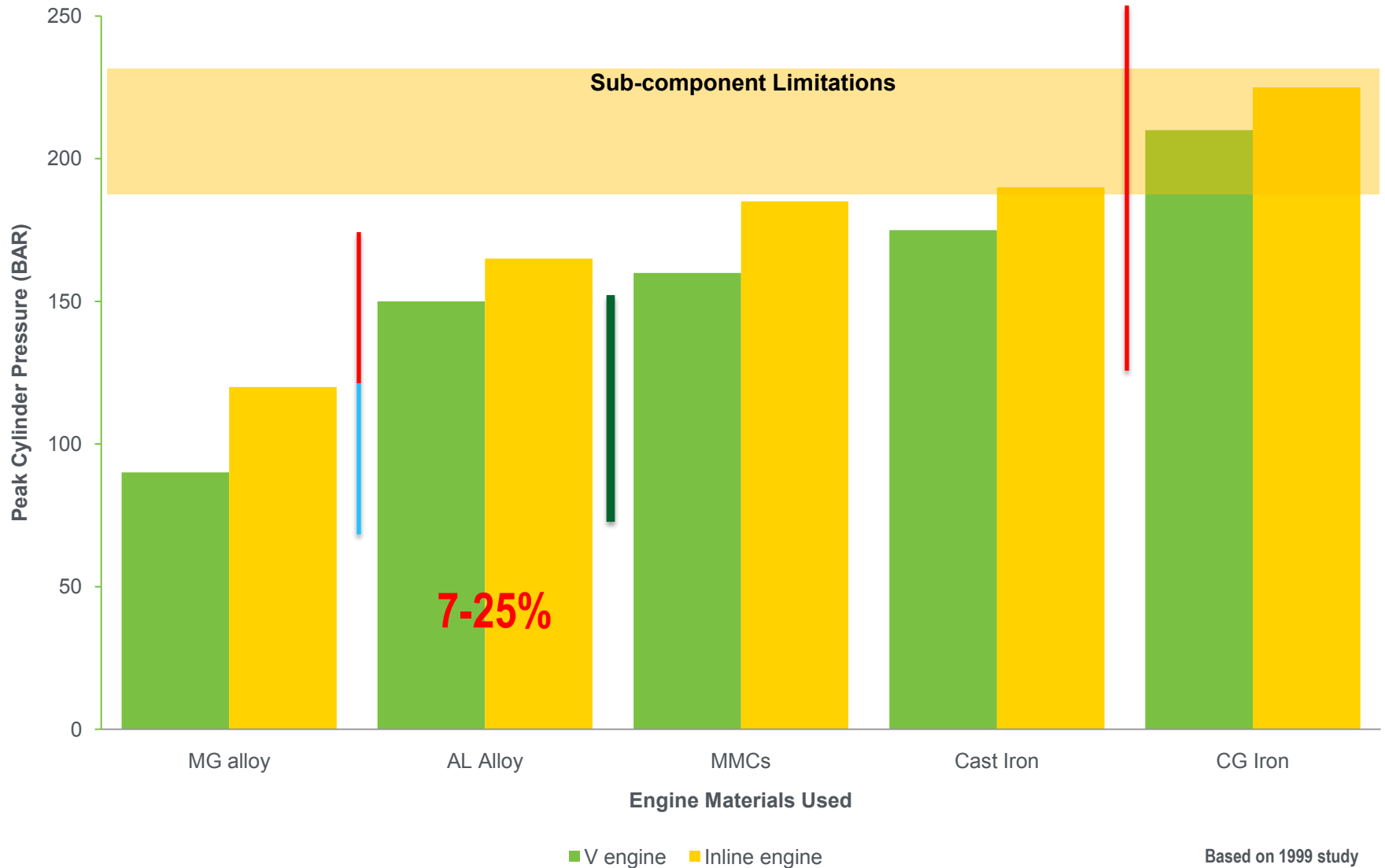
Includes both materials and manufacturing.

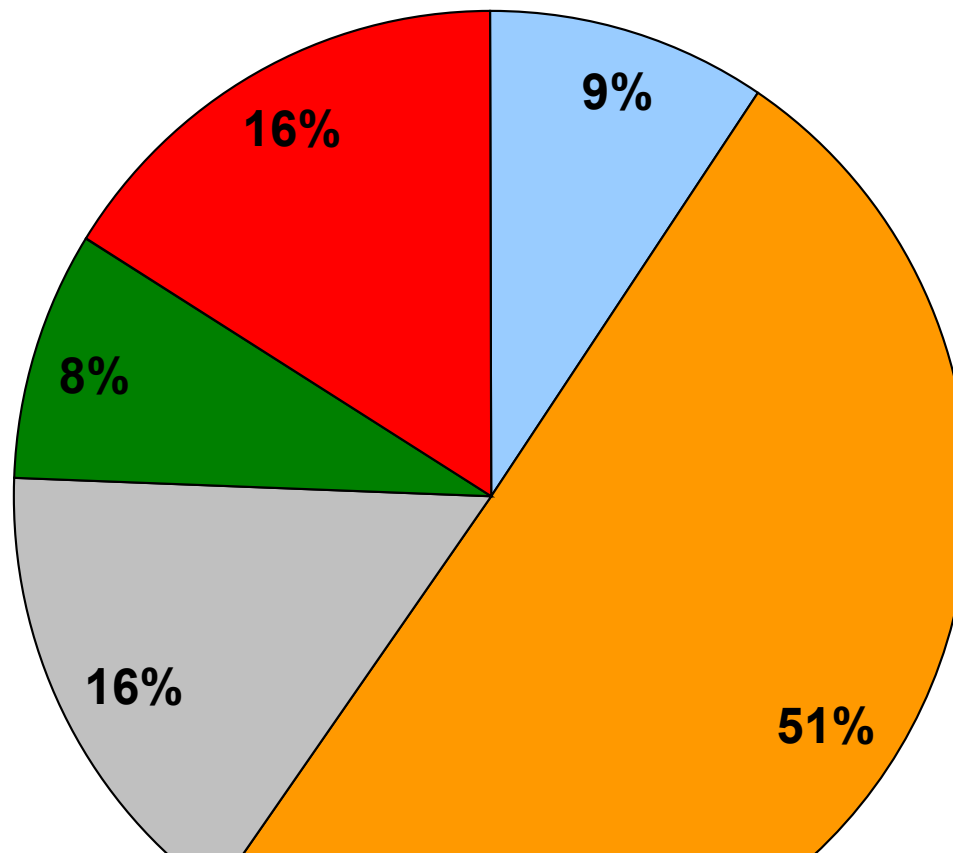
Ref: William F. Powers, Advanced Materials and Processes, May 2000, pages 38 – 41.

Heavy Duty Diesel Engine Trends



Current Material Limits





- Hybrid Electric Drive System Materials
- Materials for High Efficiency Engines
- Emissions / Durability
- Fuels Compatibility
- Materials by Design & Thermoelectric

Prospective New Agreements in Each Technology Area are Evaluated On:

- Relevance to Vehicle Technologies Program Objectives
- Supported Team's Priorities
- Potential for Co-funding from other VTP Teams
- Industry Support for Activity
- Perceived risk/benefit to program
- Mechanism for Technology Transfer
- Existing activities are evaluated annually
 - Identify activities that should be transitioned to other VTP Teams or Industry
 - Identify activities requiring changes in effort
- Approximately 12% of activities are retired each year

- Provide Outside Perspective on Project Effectiveness:
 - Is the work advancing the programs goals
 - Is the work progressing efficiently
 - Are resources being used effectively
- Provide Basis for Changes to Program
 - Assists in assigning priority to activities
 - Basis for reallocation of resources
 - Identify activities requiring changes in effort
- Approximately 12% of activities are retired each year
 - Merit Review input is used to help determine which projects need to be concluded early

Thank You

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