



**Enhancing Green Innovation and
Sustainable Practices in the
Automotive Sector**

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SAE Green Technology Steering Committee
Great Lakes Green Chemistry Network &
Michigan Green Chemistry Clearinghouse Webinar
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SAE International

- Headquartered in Warrendale, PA with Automotive Headquarters in Troy, MI
- 501.c.3 not-for-profit global association of 128,000 engineers and related technical experts in the aerospace, automotive and commercial-vehicle industries
- Share information and exchange ideas for advancing engineering mobility systems
- Standards development, events, and technical information and expertise used in designing, building, maintaining, and operating vehicles for use on land or sea, in air or space

Overview

- SAE Vision 2020
- Michigan Green Chemistry & SAE's response
- Green Technology Steering Committee
- Green Chemistry Principles in Automotive Sector
 - Materials – Recycling/reuse - Waste
- BioBased Materials in the Auto Industry
- “Green Car Factors” and Sustainable Mobility
- Lessons Learned and Future Steps

SAE Vision 2020

In the year 2020, SAE International will be #1 in the mobility industry by . . .

- Connecting a global network of students, engineers, practitioners, and companies.
- Attracting, managing, and distributing mobility-related information through:
 - Education,
 - Standards, and
 - Technical publications.
- Leading in global standardization.
- Creating and sustaining beneficial affiliations and interfaces that add value, encourage innovation, and help form sound public policy.

Environmental & Green Challenges for the Mobility Industry

- Environmental issues are critical and global
- Concerns about “sustainable mobility” and “green mobility products”—what are they?
 - Green initiatives focus on fuel efficiency, but should be more than that
 - Difficult to commercialize new auto technologies
 - Individual companies active in sustainability and the green arena
 - Challenges for industry consensus and path forward

SAE Proposed Actions for the Mobility Industry

- Provide technical information and feedback to address issues before regulations are imposed
- Make the Mobility Sector part of the solution
- Facilitate the industry's approach to be more environmentally responsive, yet cost-effective and time-sensitive
- Assure the Mobility Sector is recognized as a leader for new, green and sustainable technology

Transportation

- Almost 20 percent of the world's total delivered energy is used in the transportation sector¹
- Transportation alone accounts for more than 50 percent of world consumption of liquid fuels¹
- 14.3% of greenhouse gases worldwide originate from the transportation sector making it the third largest emission source²
- In the US alone:
 - Transportation is responsible for 2/3 of our petroleum usage¹
 - On-Road vehicles responsible for ~80% of transportation petroleum usage¹

¹US Energy Information Administration

²World Resources Institute

Auto Industry Trends

- Lightweight
- Low/zero emissions
- Alternative propulsion systems
- Reduced vehicle energy consumption
- Weight reduction to improve fuel economy
- Renewable/sustainable materials
- Recyclable materials
- Reduced waste to landfills
- Biobased materials

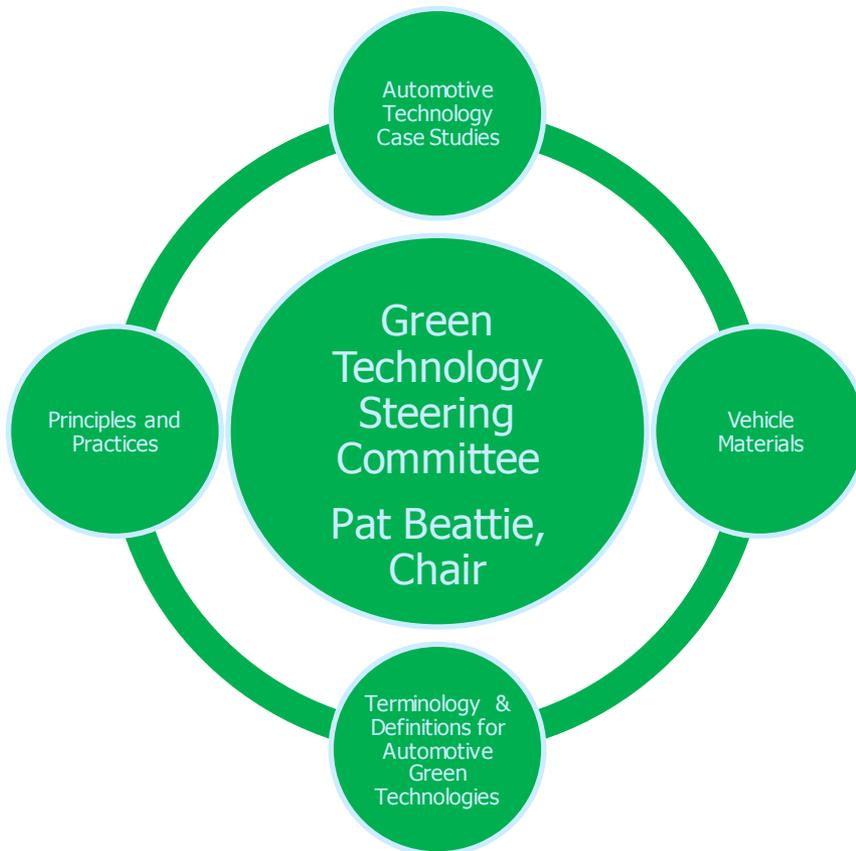
Automotive Recycling Industry

- The automobile is the world's most recycled consumer product
- In North America, 95% of retired autos are processed for recycling every year
- At least 86% of a car's material content is recycled, reused and recovered
- Recycling vehicles provides enough steel to produce almost 13 million new autos and saves ~85 million barrels of oil annually
- Products expected to last more than 15 years

Green Chemistry in Michigan as a Catalyst for Action in the Auto Sector

- 2006 Michigan Executive Directive
- 2008 Action Plan for Michigan Green Chemistry Research, Development, and Education
- Michigan Department of Environmental Quality, with support from the Michigan Green Chemistry Roundtable, awarded grant for a workshop to SAE in 2009
 - Feasibility Study for Establishing a Center for Green Innovation & Technology Transfer for the Automotive Industry in Michigan

Green Technology Steering Committee



Scope:

To serve as a guiding body for consensus standards development for environmental sustainability issues in the automotive sector:

"Meeting the needs of the present generation without compromising the ability of future generations to meet their needs."

Defining concept of green: related to the size of the environmental footprint of a product, i.e. the degree to which a product has a negative impact on human health and ecosystems

Topics for consideration include materials, energy, water, waste, recycling and reuse, and manufacturing practices

Work in Progress

- SAE J2960– “Implementation of Green Chemistry and Engineering within the Automotive Sector” under development
- SAE J2965 – “Glossary of Terms in Use in Green Innovation and Sustainable Practices in the Automotive Industry” under development
- Inventory of Green Chemistry & Engineering Case Studies from EPA Awards
- Summary BioBased Materials Workshop
- Exploring Landfill Free Attainment Best Practices
- Ongoing discussion forums on topics of interest.

Examples of Green Chemistry & Engineering Projects in the Auto Sector

Prevent Waste

- Landfill: since 2005, 78 of 156 global manufacturing as well as 14 non-manufacturing operations are landfill free at GM
- Waste: since 2000, 43% decrease in waste, with 91% of all waste recycled at GM

Design Less Hazardous Syntheses

- PPG' S Green Logic® Paint Detackifier: replaces petroleum-based and melamine-formaldehyde products.
- Zircobond Pretreatment: eliminates chrome, zinc, nickel, manganese, and phosphate from the metal pretreatment process

Example of Green Chemistry & Engineering Projects in the Auto Sector--2

Use Renewable Feedstocks

- Biomaterials in Autos
 - Biopolymers to replace existing petroleum-based resins;
 - Biobased resins: corn, castor beans, sugar cane
 - Soy, soy oil: foams, thermoset resins, fillers
 - Fillers and Reinforcements: soy and wood flour to reduce density;
 - Natural Fibers: hemp switch grass, flax, wheat straw, wood, kenaf, coconut; for thermosets and thermoplastics;
- One example of many products on the market: Biofoam soy seats
 - In over 2 million Ford vehicles
 - In GM's Chevy Volt, and
 - In Nissan's Leaf

Workshop to Characterize Biobased Materials in Vehicles for the USDA BioPreferredSM Program

A business case (Faurecia):

- Reducing vehicle component weight and overall mass reduction in the vehicle;
- Lowering emissions of green house gases, other polluting gases, including volatile organics, and reducing the overall carbon footprint of the vehicle;
- Using more natural materials and reducing reliance on petroleum products;
- Continuing to develop recycling initiatives, optimize recovery of production waste, and increase use of recycled materials; and
- Enhancing environmental performance based on life cycle analysis and assessment.

Automotive Materials Require Evaluation of Six Elements

- Cost: Need cost effective material, priced at or lower than petroleum-based options
- Performance and Quality—Safety Concerns
- Mass Reduction: Goal is to minimize mass to maximize fuel efficiency
- Reduction of Environmental Impacts: Selection of bio based or recycled materials to minimize environmental impacts of cradle-to-gate material manufacturing
- Global and Regional Availability Factors
- Available Infrastructure
 - Infrastructure to reclaim/recycle bio based materials needs to be developed
 - Quantity of material vs. robust crops and/or plants

Issues Identified in the BioPreferredSM Program by the Auto Industry

How will performance and safety criteria be incorporated into program requirements?

How will the increased costs of measurement and validation be factored into the program?

How will the business case and market for current biobased materials in vehicles change?

How will reuse or recycling of vehicle materials be balanced in concurrence with the use of biobased materials?

What flexibility will be incorporated into biobased materials (supply chain and feedstock) availability issues?

Elements in a “Green Car Factor” for Best Practices or Standards

- Direct vehicle emissions
- Fuel/energy source/environmental impact
 - Biofuels
 - Low carbon (e.g., natural gas)
 - Environmentally friendly charging sources
- Materials
 - Components: structure, panels, seats, electronics, power-train, tires
 - Service: refrigerants*, coolants, lubricants, hydraulics
 - Impact on cabin air quality (chemical releases)
- Manufacturing processes
 - Waste produced
 - Resources (water, energy) consumed
- Recyclability/disposability

Sustainable Mobility

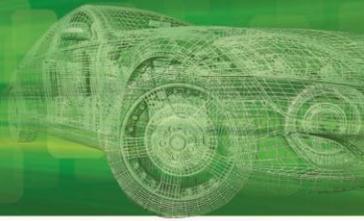
“Sustainable mobility means delivering safe, energy-efficient products that meet our customers’ needs while using the earth’s resources responsibly, minimizing environmental impacts, relying on renewable energy, and responding to differing community needs for transportation, and at the same time fulfilling our fundamental role in driving world economies.

...It depends on collaboration, automakers working with government, energy providers and consumers to advance sustainable mobility through a comprehensive integrated approach”

Auto Alliance,
Reinventing the Automobile 2011

Lessons Learned and Future Steps

- Sustainability issues are cross-cutting, generally not required by regulation or law, and not focused in discrete technical departments in companies;
- Companies address sustainability differently, but all are working on it; many have set up websites to communicate about their progress;
- No “silver bullet” of one or two activities;
- Continue progress to integrate sustainability efforts across auto manufacturers and suppliers;
- Continue to support collaboration and partnerships within the industry and encourage outreach to other industries;
- Use SAE and Michigan Green Chemistry Network to continue to identify opportunities to advance sustainability across the industry.



Conclusion

SAE is providing a forum through the Green Technology Steering Committee to address these issues and develop a framework and strategy for global standards for environmental sustainability in the mobility sector. Much progress has been made, but much is still to be accomplished.