



**NORTH AMERICA'S
PREMIER COLLEGIATE
AUTOMOTIVE
ENGINEERING
COMPETITION**

The NeXt Challenge

EcoCAR: The NeXt Challenge

is a new collegiate advanced vehicle technology competition (AVTC) kicking off in the fall of 2008. Sponsored by the U.S. Department of Energy (DOE) and General Motors (GM), as well as by Natural Resources Canada and other industry leaders, EcoCAR challenges engineering students from universities across North America to re-engineer a GM vehicle, minimizing energy consumption, emissions, and greenhouse gases while maintaining the vehicle's utility, safety, and performance.

In **EcoCAR**, students will design, build, and integrate advanced propulsion technologies into their competition vehicles, which will be classified in categories similar to the vehicle categories from the California Air Resources Board (CARB) zero emissions vehicle (ZEV) regulations. Students are encouraged to explore a variety of solutions, including electric, hybrid, plug-in hybrid, and fuel cell powertrains. In addition, they will incorporate lightweight materials, improve aerodynamics, and utilize alternative fuels such as ethanol, biodiesel, and hydrogen.

GM will provide the teams with production vehicles and parts, seed money, technical mentoring, and operational support throughout the three-year program. The DOE and Argonne National Laboratory will provide competition management, team evaluation, technical guidance, and logistical support. EcoCAR follows the successful student engineering competition, "Challenge X: Crossover to Sustainable Mobility," also sponsored by GM and the DOE.

Year One Competition Focus

The first year of EcoCAR: The NeXt Challenge is an essential foundation for establishing a successful vehicle by emphasizing the use of math-based design tools – such as the Powertrain Systems Analysis Toolkit (PSAT) or similar vehicle models – and the development of software-in-the-loop (SIL) and hardware-in-the-loop (HIL) simulation techniques. These first-year activities will form the basis for the Year One competition, as well as establish useful tools for the vehicle development and refinement tasks in subsequent years of the competition.



AVTC History

Since 1987, the U.S. Department of Energy has sponsored more than 45 AVTCs through Argonne National Laboratory. These competitions represent a unique coalition of government, industry, and academic partners who join forces to explore sustainable vehicle solutions. Argonne organizes and operates these competitions to accelerate the development and demonstration of technologies of interest to the DOE and the automotive industry, provide the automotive industry with a new generation of engineering leaders with highly desirable experience, and help prepare the market to accept advanced vehicle technologies.



EcoCAR technical goals

Student teams will construct and demonstrate vehicles that, when compared to the stock production vehicle:

- Incorporate technologies that reduce petroleum energy consumption on the basis of a total fuel cycle well-to-wheel (WTW) analysis
- Increase vehicle energy efficiency
- Reduce criteria and WTW greenhouse gas (GHG) and criteria emissions
- Maintain consumer acceptability in the areas of performance, utility, and safety



Beyond Year One Competition

The vehicle designed by each team's modeling efforts in Year One will be built and refined in a vehicle donated by GM for Years Two and Three. Students in Year Two will install their selected powertrain components and controllers into their vehicle, along with the communication protocols developed by each team. In Year Three, student teams will continue to refine their simulation, testing, and hardware control efforts while improving vehicle efficiency and function. The educational emphasis during the second and third years of EcoCAR will be on improving the operation

of each team's vehicles through an iterative test and refinement procedure by using the tools developed in the first year of the competition. The diagram below illustrates the elements of the EcoCAR: The NeXt Challenge competition, showing three tracks for mechanical, electrical, and controls development over the three years of the competition. Integrating the results from each track into a production-ready prototype vehicle is the essence of the EcoCAR challenge.

Team and Sponsor Benefits

EcoCAR sponsors support a cooperative approach in developing fuel-efficient vehicles that reduce petroleum use and provide economic and environmental benefits. Sponsors provide hardware, software, training, and support so that teams can integrate the provided technologies into their competition vehicles. This arrangement benefits students by giving them access to components that might otherwise be unavailable or too expensive. Sponsors benefit through promoting their technologies and observing their application in an innovative, realistic vehicle environment. Additionally, sponsors can meet, work with, and recruit hundreds of the nation's most motivated and talented engineering students while gaining international media coverage and developing partnerships with government, industry, and academia.

For More Information Contact:

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June 2009

Y1 Competition

	MECHANICAL	ELECTRICAL	CONTROLS
Y1 Design	Life Cycle Analysis, Vehicle Architecture Selection, and Performance Modeling		
	CAD - Component	Define Electrical Requirements	Control System Design
	CAD - Routing and Integrations	HIL Design/Setup	Simple Control and SIL/Prelim HIL
Finalized Component Selection and Acquisition			

June 2010

Y2 Competition

Y2 Mule Vehicle - Increased Focus on Outreach	Vehicle Modification	Vehicle Harness/System Design	HIL Finalization and Communication Setup
	Component Integration	Vehicle Harness Setup	HIL Testing - Safety and Fault Mitigation Implementation
	Controls Integration and Vehicle Testing		

June 2011

Y3 Competition

Y3 Optimization and Refinement	Aero, Lightweighting, Ride and Handling and Noise, Vibration and Harshness	Refinement and Optimization	Refinement and Optimization
99% Buyoff - Vehicle Ready for Production			

