



Notice of Program Interest for THE EcoCAR CHALLENGE A U.S. Department of Energy Collegiate Advanced Vehicle Technology Competition

This Notice describes an opportunity for colleges and universities with accredited engineering programs in North America to compete for the opportunity to participate in EcoCAR: The NeXt Challenge — a new international collegiate vehicle engineering competition — through a Request for Proposal (RFP) process. EcoCAR seeks to advance the level of vehicle technology capable of reducing petroleum consumption and greenhouse gas emissions (GHG) while demonstrating the real-world performance of a range of technology options. After reading this Notice, schools interested in receiving an RFP describing in detail the requirements for competing for one of the up to 16 available slots in EcoCAR are invited to express their interest by contacting the competition organizers through the process outlined below.

Background

Since 1989, the U.S. Department of Energy (DOE) has been organizing Advanced Vehicle Technology Competitions (AVTCs), which involve stimulating the development and demonstration of advanced propulsion and alternative fuel technologies. Most recently, the Challenge X competition (www.challengex.org) — a four-year competition started in 2004 — gave engineering students an opportunity to participate in hands-on research and development with leading-edge automotive propulsion systems, fuels, materials, and emissions-control technologies. For this competition, students re-engineered a crossover sport-utility vehicle to minimize energy consumption, emissions, and GHGs and yet maintain or exceed the stock vehicle's utility and performance.

About EcoCAR

The EcoCAR Challenge is a three-year competition that builds on the 19-year history of DOE AVTCs by giving engineering students the chance to design and build advanced vehicles that demonstrate leading-edge automotive technologies, with the goal of minimizing the environmental impact of personal transportation and illustrating pathways to a sustainable transportation future. DOE has again joined General Motors (GM), Natural Resources Canada, and other sponsors for this new competition series, named the EcoCAR Challenge. Argonne National Laboratory, a DOE R&D facility, will organize and operate the EcoCAR Challenge.

The technologies explored in EcoCAR are identical to the ones that are under investigation by the automotive industry to meet the demands of improved energy efficiency and dramatic reductions in GHGs, as well as to address California zero emissions vehicle (ZEV) regulations. These technologies include full-function electric, hybrid, plug-in hybrid, and fuel cell hybrid vehicles. The only fuels

approved for use in EcoCAR are E-10 ethanol, E85 ethanol, B20 bio-diesel, compressed gaseous hydrogen, and the energy carrier electricity.

Teams selected on the basis of their response to the EcoCAR RFP will design and integrate advanced-technology powertrains, lightweight materials, and aerodynamic improvements into a production vehicle, with the goal of minimizing the environmental impact of personal transportation and leading the way to a sustainable transportation future. Using this approach, EcoCAR will explore pathways for future vehicles while giving the student participants the knowledge and experience they need to rapidly develop critical engineering skills and become the next generation of leaders in the automotive industry.

Nature of the EcoCAR Challenge

EcoCAR will be a unique competition employing advanced vehicle technologies based on the California Air Resources Board (CARB) requirements for Zero Emission Vehicle credits¹. The vehicle types supported in EcoCAR will be (similar to CARB Types D, E, II, and III):

- ⇒ Hybrid vehicle < 50 kW hybrid power
- ⇒ Hybrid vehicle > 50 kW hybrid power
- ⇒ Range-extender and full-function electric vehicles
- ⇒ Hydrogen Fuel Cell Vehicles

EcoCAR is based on a real-world integrated vehicle design and development process. Teams of engineers from the selected schools will develop their vehicles following a modified GM Global Vehicle Development Process (GVDP) for each phase of the three-year competition. By the end of the competition, the sponsors expect fully developed vehicles equivalent to prototypes ready for a production decision. While applying proven methods for engineering successful prototype vehicles, students will learn real-world engineering skills that will make them highly effective in the automotive industry. At the conclusion of each of EcoCAR's three years, a week-long competition involving all of the participating schools will take place in June at a GM vehicle proving ground or other appropriate location in North America.

Overview of the Three Years of EcoCAR

The first year of the EcoCAR Challenge is an essential foundation for establishing a successful design. Year One of the competition will emphasize vehicle design through the Powertrain Systems Analysis Toolkit (PSAT²) or a similar simulation tool, the development of sophisticated software-in-the-loop (SIL) and hardware-in-the-loop (HIL) simulation techniques, and rapid control system prototyping. These first-year activities will prepare schools for the vehicle development and refinement tasks in subsequent years of the competition, as well as form the basis for the Year One competition.

The powertrain components and controllers obtained by the schools and communication protocols developed by each team in the first year will be installed in a vehicle donated by GM for Year Two of

¹ Final Regulation Order "The 2003 Amendments to the California Zero Emission Vehicle Regulation," Jan. 9, 2004, <http://www.arb.ca.gov/regact/zev2003/fro.pdf>.

² Powertrain Systems Analysis Toolkit, <http://www.transportation.anl.gov/software/PSAT/index.html>.

EcoCAR. During Years Two and Three, students will build the vehicle designed through their modeling efforts in Year One and continue to refine their simulation, testing, and hardware control efforts while improving vehicle efficiency and functionality. The educational emphasis during the following years of EcoCAR will be on improving the operation of their vehicles and refining and validating the vehicle simulation models with test data from the vehicles they have built.

Support Provided to Schools Participating in EcoCAR

Over the duration of the EcoCAR competition, teams will receive \$10,000 in seed money in Year One, a wide range of powertrain components, a vehicle donated by GM, and technical/mentoring support from the competition sponsors. EcoCAR teams will also have a GM mentor knowledgeable in technologies relevant to the team assigned to assist them during the competition. We also expect to provide substantial seed money to each university to support a full-time graduate student who will provide the team with leadership and continuity over the three-year program.

EcoCAR expects to provide the teams with such powertrain components as state-of-the-art traction batteries, a range of production spark-ignited and diesel engines and transmissions, GM 2 Mode hybrid electric vehicle transmissions and transaxles, a selection of different sized electric motors and controllers, and a very limited number of automotive-grade fuel cells. Some components may not be provided, and teams are not required to use any components offered. More information on the EcoCAR components to be donated to participating schools will appear in the RFP. In prior AVTCs, each team has benefited from over \$700,000 in cash, components, and primarily in-kind support. EcoCAR expects to exceed this level of support over the three years of the competition. Also, participating teams have typically been successful in leveraging support from AVTC sponsors into additional state and local support and sponsorship for their programs.

School Support Required for Acceptance into the EcoCAR Challenge

Schools will be required to match cash seed money donations from EcoCAR sponsors and to provide class credit for students participating in the competition, release time equal to at least one class per semester for a faculty advisor from the engineering school, and logistical and promotional support for their team. Teams may also be asked to match seed money each year to support a full-time, graduate-level engineering team leader. A signed letter of support will be required from the Dean of the Engineering Department with each proposal. If accepted into EcoCAR, each school will be required to sign an annual Good Faith Agreement reaffirming the school's full support of their team and explicitly stating its willingness to participate in all EcoCAR activities with at least one faculty advisor in attendance.

Proposal Evaluation Process

Proposals for acceptance into the EcoCAR Challenge will be judged on the basis of the content and rationale of the vehicle design submitted and the vehicle's projected energy consumption, emissions, performance, and design feasibility. Equally important to design in the selection process will be the extent to which the proposing team's school will provide support, the facilities available to the proposing team, and documented team experience and expertise that persuades the reviewers that a team from that school will be successful in building and developing their chosen design.

The EcoCar Proposal Process

The EcoCAR RFP selection process is open to accredited engineering schools in Canada, the United States of America, and Mexico. The EcoCAR RFP will be available December 3, 2007. The organizers expect to have an open teleconference to discuss the details of the proposal and selection process early in January 2008; additional resources will be available from our website at www.challengex.org until the new EcoCAR website has been established.

Final proposals for EcoCAR are due March 3, 2008. To receive an EcoCAR RFP, interested schools must complete an online Notice of Interest form, which can be found at <http://survey.constantcontact.com/survey/a07e26r1ymuf8d4xrj4/a007f8g8jae1/questions>. The RFP will be distributed after December 3, 2007, and selected participants will be announced in spring 2008.

For more information about similar DOE-sponsored competitions, please visit www.challengex.org or www.transportation.anl.gov/research/competitions.

Technical and administrative questions about the EcoCAR competition can be addressed to EcoCAR@anl.gov.



The Advanced Vehicle Technology Competition program
is managed by Argonne National Laboratory
for the U.S. Department of Energy.

www.transportation.anl.gov/competitions

