



## EcoCAR 2: Plugging In to the Future

**Parker motor helps bring team victory in Advanced Vehicle Technology Competition.**

The challenge is deceptively simple: Reduce the environmental impact of a 2013 Chevy Malibu without compromising performance, safety and consumer acceptability. Taken on by 15 universities across North America, this task is the core of EcoCAR 2, a three-year Advanced Vehicle Technology Competition created by the U.S. Department of Energy (DOE) and General Motors, manufacturer of the Malibu. This competition's winner, announced in June, was the team from Ohio State University, which won using two Global Vehicle Motor (GVM) series traction motors and inverters donated by Parker Hannifin.

EcoCAR 2 required students to explore a variety of powertrain architectures focusing on electric-drive vehicle technology. The Ohio State team consistently met incremental goals that strengthened their position against the other university teams. (The University of Washington and Penn State University teams finished second and third.) Ohio State's series-parallel plug-in hybrid Malibu excelled at GM's Proving Grounds in Milford, Michigan, where it was put through a series of strenuous technical and safety tests similar to those used for real-world production vehicles, including acceleration, braking, max lat, autocross, drive quality, dynamic consumer acceptability and an emissions and energy consumption (E&EC) event.



The teams also went through two static events in Milford: consumer acceptability and vehicle testing complete. The second week of competition moved the teams to Washington, D.C., where they gave all technical presentations about their vehicles and had a ride-and-drive session at the Department of Energy for DOE employees, U.S. senators and U.S. representatives.

Ohio State modified its car to have energy storage and electric drive and run on both electricity and E-85, an alternative fuel. The team's unique design achieved 50 miles per gallon gas equivalent, while using 315 Watt-hours per mile of electricity. The vehicle impressed the judges with stellar numbers and even lessened the amount of criteria emissions by half, compared to the base vehicle.

Also contributing to the team's victory was Parker's GVM, with the motor's low weight and high power boosting the overall performance of the vehicle. "The Parker Hannifin GVM electric motors helped the Ohio State team achieve first place in the final year of EcoCAR 2 due in part to their highly efficient operation and reliability," says Matt Yard, OSU EcoCAR 2 team leader. "Parker Hannifin, through

countless hours of technical support, helped the team pair the GVM motors with the Parker inverters and get them running reliably in the vehicle.” The Ohio State team placed one motor and an inverter at the front of the powertrain and one in the rear, giving their vehicle a series-parallel hybrid configuration with all-wheel drive.

“With these motors and an E85-fueled engine, the vehicle could operate in all-electric charge-depleting mode, charge-sustaining series mode or charge-sustaining parallel mode,” says Jason Ward, a mechanical engineering grad student at Ohio State and the engine team lead.

“Having such flexibility in operating modes allowed the Ohio State Malibu to achieve the lowest criteria emissions -- besting the stock Malibu emissions by a factor of almost 2 -- and best petroleum usage during the competition. These were crucial parts of the E&EC event and would not have been achievable without the support of Parker.”

Parker also provided other technical support to the OSU EcoCAR 2 team. “Throughout the process of developing the controls for the vehicle and doing calibration work, Parker supported the team by giving data and information needed to complete the calibration of electric machines for full use in the team's control strategy,” adds Ward. “When needed, Parker provided technical support and dynamometer time for the electric machines and inverters.”



**Parker's GVM motor**

“Ohio State met and exceeded the EcoCAR 2 goals at every point in the competition,” says Dr. Michael Knotek, Deputy Under Secretary for Science and Energy, U.S. Department of Energy. “Their innovative work has contributed significantly to the future of energy efficient technology in the automotive industry, and we wish all members of the team the best as they move forward in the next step of their careers, whether in the classroom or in the professional world.”

The Ohio State team will be competing in the next Advanced Vehicle Technology Competition: EcoCAR 3. EcoCAR 3 will be a four-year competition in which teams will re-engineer a Chevrolet Camaro into a hybrid vehicle. As with this year’s competition, students participating in EcoCAR 3 will operate out of Ohio State’s Center for Automotive Research, an interdisciplinary research center in the university’s College of Engineering.

For more details on Parker’s GVM motor, click [here](#).

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