1998 ETHANOL VEHICLE CHALLENGE

U.S. Department of Energy

General Motors Corporation

Natural Resources Canada

"We Got Great Results!"

About the Challenge

In the Advanced Vehicle Technology Competitions sponsored by the U.S. Department of Energy, college engineering students work together to design, build, and evaluate a state-of-the-art vehicle. For the 1998 Ethanol Vehicle Challenge, the goal was to convert an award-winning Chevrolet Malibu sedan into an optimized vehicle fueled solely by E85 (a blend of 85% denatured ethanol and 15% gasoline-like hydrocarbon primer). The competition required that the vehicle have improved fuel economy, low exhaust emissions, and excellent cold starting, without sacrificing driveability and performance.

Each of the 14 schools selected to participate in the Challenge received a 1997 Malibu powered by a 3.1-L V6 engine, plus a spare engine from General Motors for development purposes. Student teams replaced or upgraded major engine and fuel-system components for ethanol operation. As they worked on their vehicles, the students used creative, innovative thinking to help solve real-life engineering problems and make complex decisions as a team.

Vehicles were tested and scored on exhaust emissions, fuel economy, acceleration, driveability, handling, range, and cold-start performance. Teams also received points for a written design report and an oral technical design presentation. Winners received cash awards, and the best oral report was presented at the 1998 Clean Cities Conference in Washington, D.C.

1998 Ethanol Vehicle Challenge Teams

And the Winners Are...

First	Wayne State University
Second	University of Waterloo
Third	Univ. of Illinois at Chicago
Fourth	Univ. of California, Riverside
Fifth	Cedarville College
Best Engine-Out Emissions	Kettering University
Most Innovative Component	Idaho State University
Best Vehicle Appearance	Univ. of Nebraska-Lincoln
Best Handling	Mankato State University

Other Participants...

Crowder College
Illinois Institute of Technology
University of Kansas
University of Texas at Austin
University of Texas at El Paso

WE ARE ALL WINNERS

"We Got Great Results!"

Students from 14 North American universities had just completed a grueling five days of testing on their state-of-the-art ethanol-fueled vehicles at General Motors Proving Grounds in Milford, Michigan. With several months of intense effort to get their vehicles ready for the Ethanol Vehicle Challenge already behind them, one would think the student teams would be feeling a letdown, and maybe even a little bit of exhaustion. Not so!

Having outdone themselves in using innovative technologies to transform a Chevrolet Malibu into an ethanol-burning car, the student teams and their vehicles embarked on a two-day, 600-mile caravan that ended with their joining the Clean Cities Conference parade in Washington, D.C.

And the mood as they completed the competition and headed out? Elation? You bet. Pure enjoyment of the competition? Without a doubt. Pride in their accomplishments? Most definitely!

Those feelings were shared by everyone involved in this year's Challenge, participants and sponsors alike. And with good reason. The competition resulted in several significant technical accomplishments!

Event-Specific Accomplishments

Fuel Efficiency: Most vehicles tested on the dynamometer exceeded the fuel efficiency of the stock Malibu, with the best schools showing efficiency improvements of 13 to 15%. In fact, in the city portion of the dynamometer testing, all the vehicles demonstrated a higher fuel efficiency than the stock Malibu.

Cold Start: Several potentially important cold-start technologies emerged. The best vehicles in this event started as quickly as vehicles fueled by gasoline — an excellent achievement! The vehicles were tested after being cold soaked at 20°F overnight and low-volatility fuel was used (simulating a 0°F start).

Driveability: This "companion" test to cold start measures a vehicle's ability to deliver a good driving experience in cold weather. Several significant technical approaches to improving driveability were developed and demonstrated. In testing on a chassis dynamometer in the 20°F cold room, the best vehicles had driveability ratings as good as, or better than, those of the stock gasoline vehicle.

Emissions: Five of eight vehicles tested showed emissions equal to, or less than, those produced by the stock gasoline-fueled Malibu, but not lower than existing Federal Tier 1 standards. This emphasized the difficulty of achieving low emissions while maintaining or improving performance, driveability, and fuel efficiency. General Motors used the competition vehicles to test and validate a new diagnostic instrument that could reduce the cost for emission testing of alcohol-fueled vehicles.

Acceleration: By taking advantage of E85's higher octane value and increased in-cylinder cooling, most of the teams demonstrated that dedicated E85 vehicles can accelerate as quickly as, or quicker than, the stock gasoline-fueled Malibu.

Handling: Consumer acceptability can be influenced by trade-offs made between ride and handling. Teams enjoyed their freedom to modify suspension settings, and some used more "aggressive" tires to improve the handling.

Vehicle Appearance: Student teams greatly enjoyed modifying their vehicles' appearance, much to the delight of the GM Malibu Brand Manager.

Some REALLY Cool Stuff!

Among the many innovative technical solutions used by the student teams are

- Onboard distillation of cold-start fuel (Univ. of Texas at Austin & Univ. of California, Riverside)
- Glow-plug-ignited alcohol engine (Idaho State University)
- Electric supercharger and intake-port glow plugs (Cedarville College)
- Quick-heat intake manifold (Wayne State University)
- Liquid-heated fuel injector rail (University of Waterloo)

Competition Demonstrates Ethanol's Potential

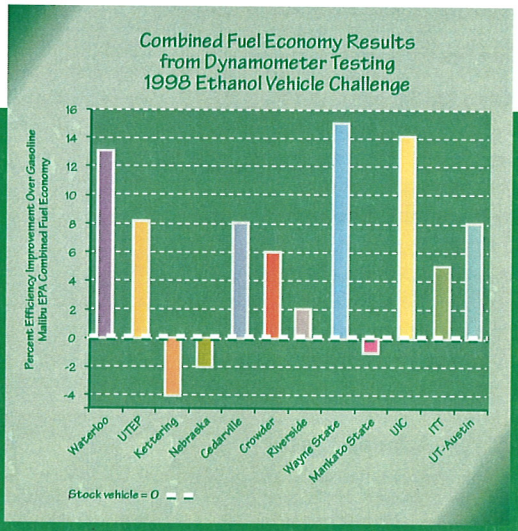
Because flexible-fuel E85 production vehicles are already on the road, there may be a general perception that there isn't a need for the Ethanol Vehicle Challenge. Not so. Just as research has continued through the years to improve the efficiency, performance, and safety of gasoline-fueled vehicles, a great deal must yet be accomplished technically before E85 production vehicles are fully optimized. The technical innovations developed by this year's Challenge teams took several steps in that direction!

The teams demonstrated that cold-start problems caused by dedicated E85 operation could be overcome. Their vehicles delivered significantly improved fuel efficiency and good emissions. By doing so, the student teams took a giant step toward demonstrating that E85 used in dedicated vehicles has the potential to provide significant benefits to the nation and the environment.

Looking to the Future

The excellent results of this year's competition lay the groundwork for another year of exploring the benefits and limits of using fuel ethanol in dedicated vehicles. DOE and the ethanol industry are committed to sponsoring another Ethanol Vehicle Challenge in 1999. GM is also committed to the 1999 Ethanol Vehicle Challenge, bringing on board the company's Truck Group for this year's event. Thanks to GM's generosity, each team will receive a new 1999 Chevrolet Silverado with a 5.3 liter, Gen III V8-engine for next year's competition. The 1999 Challenge looks to be even more exciting than this year's!

We invite your organization or company to join us in supporting next year's competition and making it even better. By doing so, you will reap the many benefits of sponsorship while helping to advance sustainable transportation technologies and set the world on a path to a more environmentally responsible future!



Want to Become Part of This Exciting Venture?

Your company can support the 1999 Ethanol Vehicle Challenge in three ways:

- Major Sponsor, providing support for the overall execution of the competition
- Associate Sponsor, providing resources at the event level, benefitting all teams
- Local Sponsor, providing resources to specific teams.

Supplies, logistical support, and volunteer services are also welcome.

For Information About Sponsoring the 1999 Ethanol Vehicle Challenge, Contact

Shelley Launey
Manager, University and Small Business Programs
U.S. Department of Energy (EE-32)
1000 Independence Avenue, SW
Washington, DC 20585
phone: 202/586-1573
fax: 202/586-1600
e-mail: shelley.launey@ee.doe.gov

Cindy McFadden
Argonne National Laboratory
9700 S. Cass Avenue
Argonne, IL 60439
phone: 630/252-1353
fax: 630/252-3443
e-mail: cmcfadden@anl.gov

With Thanks to Our 1998 Sponsors

Headline Sponsors

U.S. Department of Energy

General Motors Corporation

Natural Resources Canada — Natural Resources Canada

Sponsors

Illinois Department of Commerce and Community Affairs — DCCA

Council of Great Lakes Governors — Council of Great Lakes Governors

Renewable Fuels Association — RFA

Illinois Corn Marketing Board — Illinois Corn Marketing Board

Supporters

Governors' Ethanol Coalition
Canadian Renewable Fuels Association
National Corn Growers Association
Williams Energy Services Group
The Goodyear Tire & Rubber Company
Howell Hydrocarbons and Chemicals
Delphi Automotive Systems
GROWMARK

Competition Administrator

Center for Transportation Research, Argonne National Laboratory, operated by The University of Chicago as part of the U.S. Department of Energy's national laboratory system.

1998 ETHANOL VEHICLE CHALLENGE

For more information on advanced transportation technology competitions sponsored by the U.S. Department of Energy and its partners, visit Argonne National Laboratory's web site www.transportation.anl.gov. To subscribe to FutureDrive, a free newsletter about the competitions send e-mail to ckaicher@anl.gov.