ETHANOL VEHICLE CHALLENGE

Plant an Idea...

Watch it Grow.

"The results of the Ethanol Vehicle Challenge and other student competitions are dramatic testimony to the promise of alternative fuel vehicles."

— Shelley Launey, DOE

It started out as a bright idea in 1996, and by 1998, the Ethanol Vehicle Challenge was a full-fledged engineering competition involving more than 200 students from 14 North American colleges and universities. The challenge? To convert a standard gasoline vehicle to run solely on E-85 — a mix of 85% ethanol and 15% gasoline. Experts knew that ethanol offered a cleaner alternative to gasoline, but a lack of public awareness about alternative fuels inhibited its widespread use.

The goals of the competition — sponsored by the U.S. Department of Energy, General Motors, National Resources Canada, and nearly two dozen government and private sponsors — were to demonstrate the potential of ethanol to significantly lower emissions, improve performance, increase fuel efficiency, and improve cold starting of vehicles.

We saw many changes over the three years of the competition. The platform changed — from a 5-passenger sedan (a Chevrolet Malibu) to a full-size truck (a Chevrolet Silverado) — to reflect consumer demands for larger vehicles and more power. The venues changed — from GM's Milford Proving Ground in Michigan to a 7-day tour through Ontario, Canada. Events were added (off road, hill climb, trailer tow) or made more challenging (lower cold start temperature). And, as the competition grew, so did the level of technical and financial support from the sponsors — for the 1999 and 2000 competitions, GM modified the Silverado's powertrain control module according to the students' specifications.

"As automotive advances, like those resulting from the Ethanol Vehicle Challenge, enhance the performance of vehicles designed to run on ethanol and as production becomes more efficient, ethanol will become a key part of the solution to global climate change."

— Jim Redding, Williams Ethanol, Sponsor

The one thing that did not change was the dedication and enthusiasm of the students and their sponsors and advisors; more than 600 students dedicated nights, weekends, and much of the rest of their free time to overcome the significant technical and financial obstacles of the competition. The sponsors and faculty advisors dedicated countless hours providing technical guidance and encouragement. With their support, the students became better engineers, acquiring new skills and sharing new insights. The technologies became more sophisticated and the achievements more impressive. By the time the last Silverado crossed the finish line after the 2000 competition, Ethanol Vehicle Challenge participants had proven that ethanol-powered vehicles could achieve fuel efficiency, performance, driveability, and reliability comparable with those of gasoline-fueled cars while significantly lowering emissions. And, most important, they had proven that the future of automotive engineering is in very capable hands.

In 2000, the winning vehicle in the emissions event (University of Illinois at Chicago) met the California Air Resources Board ultra-low emissions vehicle (ULEV) standard — one of the toughest in the world.

2000 EVC Award Winners

Award	School
1st Place	University of Texas at Austin
2nd Place	University of Waterloo
3rd Place	University of California, Riverside
4th Place	University of Texas at El Paso
5th Place	University of Illinois at Chicago
Best Fuel Economy	University of Illinois at Chicago/ University of Waterloo
Lowest Emissions	University of Illinois at Chicago
Best Cold Start	University of Texas at Austin
Best Ethanol Conversion	University of Waterloo
Most Innovative Component	University of Texas at Austin
Best Oral Presentation	University of Texas at El Paso
Best Appearance	Wayne State University
Simon Vega Sportsmanship Award	Minnesota State University — Mankato
Governors' Ethanol Coalition Outstanding Faculty Advisor Award	Dr. Williams Weins and Dr. Alexander Peters (University of Nebraska — Lincoln)

"Our team, as well as nearly every other team in the competition, proved that through a little reengineering, a group of students can produce a vehicle with significantly lower emissions, better fuel economy, and overall better vehicle performance while operating on a totally different fuel."

— Clark Otte, EVC Team Leader
University of Nebraska, Lincoln

Innovations

- Phase-Changing Catalytic Converter
- Distillation Columns (to separate out volatile hydrocarbons)
- Innovative Intake Air Devices
- Fuel Heating Devices

Way to Go Teams!

Cedarville College, Ohio
Crowder College, Missouri
Idaho State University
Illinois Institute of Technology
Kettering University, Michigan
Minnesota State University — Mankato/
University of Windsor, Ontario*
University of California, Riverside
University of Illinois at Chicago
University of Kansas
University of Nebraska — Lincoln
University of Texas at Austin
University of Texas at El Paso/
University of Alberta, Ontario*
University of Waterloo, Ontario
Wayne State University, Michigan

*Collaborated with a U.S. team in the 2000 competition.

"The competitions undoubtedly provided students with a more valuable and rewarding experience than any other they will have in college."

— Dr. Ryan Wicker, Advisor
University of Texas at El Paso

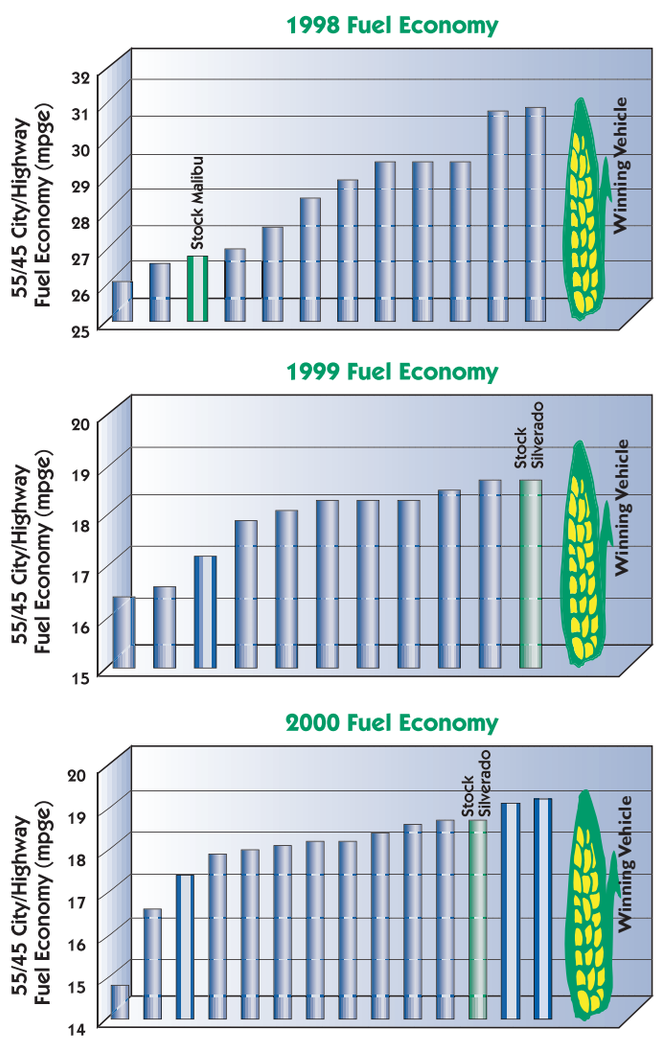
A Big Thanks to Our 1998-2000 Sponsors

Headline Sponsors

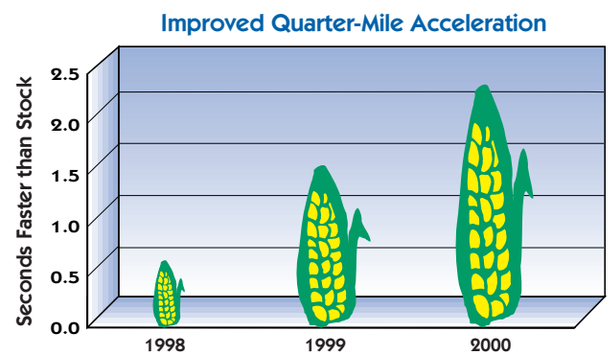
U.S. Department of Energy
General Motors Corporation
General Motors of Canada, Ltd. (2000)
Natural Resources Canada

Sponsors and Supporters

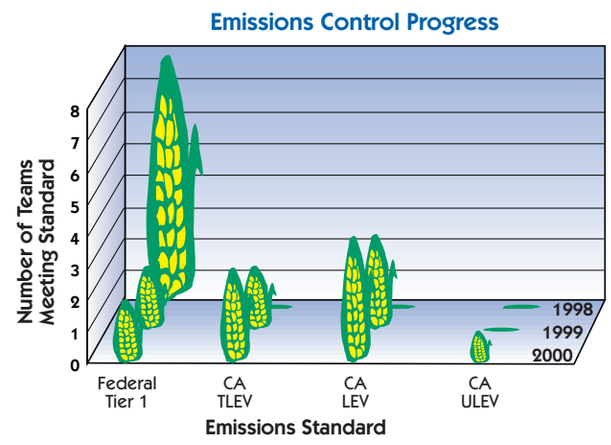
Canadian Renewable Fuels Association
Illinois Corn Marketing Board
Illinois Department of Commerce and Community Affairs
Renewable Fuels Association
Williams Bio-Energy
Council of Great Lakes Governors (1998, 1999)
Delphi Automotive Systems (1998, 1999)
Governors' Ethanol Coalition (1999, 2000)
National Corn Growers Association (1998, 1999)
Commercial Alcohols, Inc. (2000)
Environment Canada (2000)
Iogen Corporation (2000)
Ontario Corn Producers Association (2000)
Ontario Ministry of Agriculture, Food, and Rural Affairs (2000)
Petro-Canada (2000)
UPI, Inc. (2000)
State of Nebraska (1999)
The Goodyear Tire & Rubber Company (1998)
Growmark (1998)
Howell Hydrocarbons and Chemicals (1998)



In 1998, 10 of the 13 converted Chevrolet Malibus outperformed the stock vehicle in 55/45 city/highway fuel economy (on a miles-per-gasoline-equivalent-gallon (mpge) basis). In 1999 and 2000, while working on the less fuel-efficient Silverado, four of the teams still managed to develop a more fuel-efficient vehicle than the stock truck.



Each year of the competition, the students significantly increased the acceleration advantage of the ethanol-fueled vehicle — proving that ethanol can compete with gasoline in both power and performance. The winning team in the 1998 Ethanol Vehicle Challenge accelerated 0.66 seconds faster than the stock vehicle; in 1999, it was 1.6 seconds faster; and in 2000, the winner beat the stock vehicle by 2.43 seconds.



As the competition progressed, a greater number of the teams met more stringent emissions limits, a result of experience gained and increased technical support from GM. Especially impressive: the students achieved these emissions standards in the last two years of the Challenge while working on the larger, more mechanically complex, and more difficult-to-control Silverado.

"These competitions help us to gain entry into research and development programs that are of vital interest to our country."

— Dr. Gregory W. Davis, Advisor
Kettering University

"Over the past year, you have embarked on what I believe is an unparalleled educational experience; an experience that provides you with a hands-on opportunity to tackle 'real-world' automotive engineering challenges. Many of the cutting-edge ideas resulting from this challenge will be implemented in the vehicles of the future. Many of you who optimized these vehicles will become leaders in the automotive industry."

— Ralph Goodale, PC, MP
Minister of Natural Resources Canada

A Fuel Whose Time Has Come

Americans already use more than 15 billion gallons of ethanol-blended gasoline annually to improve vehicle performance and reduce emissions. In the U.S., production of over 1.5 billion gallons of ethanol each year increases net farm income by $4.5 billion, boosts total employment by almost 200,000 jobs, adds over $450 million to state tax receipts, improves the U.S. trade balance by $2 billion, and results in a net savings in the federal budget of over $3.6 billion.* In Canada too, ethanol production has grown into a significant industrial sector over the past 20 years, with plants in four provinces producing 62 million gallons of ethanol; this number is expected to increase to over 178 million within the next three years. Ethanol has added over 5,000 new jobs to the Canadian economy, and farmers have seen a 10¢-a-bushel benefit due to ethanol production. In 2000, more than 1,000 retail outlets across Canada sell ethanol blends, accounting for 5% of the gasoline fuel market. Made from renewable crops, ethanol also reduces U.S. and Canadian dependence on foreign oil imports.

In greater concentrations (like in E-85), ethanol is the only liquid fuel that actually reduces greenhouse gas emissions because it represents a renewable carbon cycle — in other words, the carbon dioxide emitted by ethanol-burning vehicles is reused by the crops and plants from which ethanol is made. Burning fossil fuels, on the other hand, releases carbon into the air, where it reacts with oxygen to form carbon dioxide, a greenhouse gas that may contribute to global climate change.

Because it burns cleaner than other fuels, ethanol also significantly reduces tailpipe emissions like carbon monoxide, nitrogen oxides, volatile organic compounds, benzene, and toluene. Unlike other alternative transportation technologies, ethanol requires no special infrastructure to achieve these emission benefits.

* *The Economic Impact of the Demand for Ethanol*, Dr. Michael Evans, Professor of Economics, Kellogg School of Management, Northwestern University (1997).

In 1999, 12 of the 14 converted Chevrolet Silverados accelerated faster than the stock truck in the 1/4 mile event, while outperforming it on an mpge basis.

After the 1998 competition, 64% of graduating students from the Ethanol Vehicle Challenge accepted jobs within the automobile industry.

Competition Administrator

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

For more information on DOE-sponsored student competitions, please check out Argonne's Transportation Technologies Research and Development Center web site at http://www.transportation.anl.gov ("What's New in Student Competitions").