

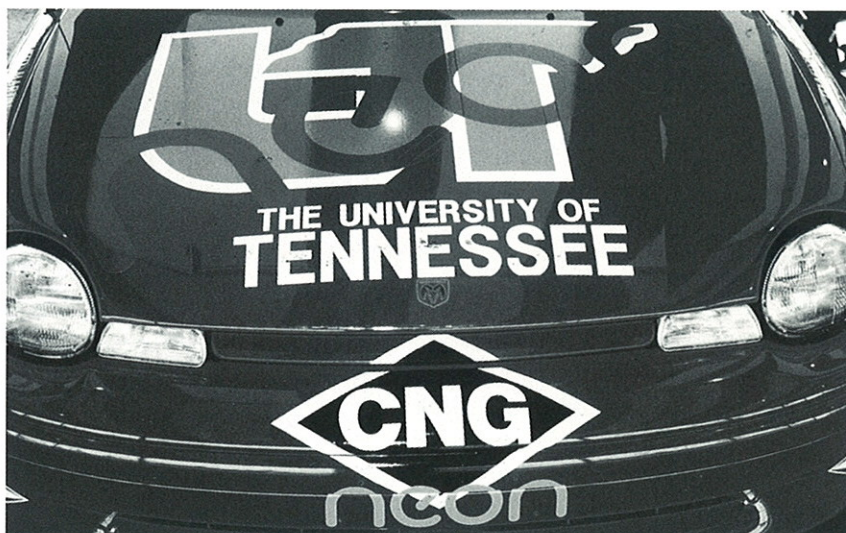
## TECHNOLOGY FEATURE

### Solectria and University of Tennessee Surpass Milestones in Separate DOE-Sponsored Competitions

**T**he Solectria Sunrise sedan set a new course range record by completing 238 miles on a single battery charge in mixed city/highway driving at the 1995 American Tour de Sol (ATdS), an annual five-day road rally for innovative electric vehicles from around the nation. The all-composite, four-passenger electric car then went on to win first place in its class.

Equally impressive in its own way was the University of Tennessee's entry in the Chrysler Neon Class at the 1995 Hybrid Electric Vehicle Challenge, which was held at the Chrysler Technology Center in Auburn Hills, Michigan. (See pp. 4-5.) The hybrid-electric vehicle (HEV) attained emissions levels that were better in every category than those of the California Ultra-Low Emissions Vehicle (ULEV) standard.

The ULEV standard places maximum emissions levels at 0.039 grams per mile (gpm) for nonmethane hydrocarbons (NMHC), 1.7 gpm for carbon monoxide (CO), and 0.2 gpm for nitrogen oxides (NO<sub>x</sub>). By contrast, the University of Tennessee vehicle's levels



were 0.02 gpm NMHC, 0.50 gpm CO, and 0.05 gpm NO<sub>x</sub>.

The University of Tennessee's design incorporated modifications to the engine and the emissions control strategy to permit running on compressed natural gas. The team used prototype fuel injectors, originally developed by Old Dominion University students and donated by Siemens Automotive, for the '93 Natural Gas Vehicle Challenge. They also used an Electromotive TEC-2 engine controller for emissions and power optimization control.

The Sunrise's 238-mile range record was attributed to the use of strong, lightweight composite materials; a sleek, aerodynamic design; and a special nickel-metal hydride battery pack produced by the Ovonic Battery Company, a subsidiary of Energy Conversion Devices, Inc. This type of battery is common

in laptop computers but is not commercially available in sizes suitable for automobiles. However, Ovonic has entered into a joint partnership with General Motors in the hope of soon producing the batteries for automotive use.

Other milestones achieved in 1995 DOE-sponsored competitions: Bolton High School's entry in the ATdS traveled 143 miles (a record distance for a student electric vehicle) powered by common lead-acid batteries. In Sunrayce 95, a collegiate competition for solar-powered vehicles, the Massachusetts Institute of Technology finished first by averaging a record 37.23 mph over the nine-day, 1,150-mile course. (See articles on p. 7 and p. 8.) For complete '95 competition results, see pp. 4-11.

Vic Comello  
Senior Technical Writer  
Argonne National Laboratory

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## FUTUREDRIVE

Volume 1, Number 3, Autumn 1995

**Purpose**

To inform past, present, and potential sponsors, participants, organizers, volunteers, and others interested in DOE-sponsored vehicle competitions about the plans for and results from the competitions.


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FutureDrive is published by the Energy Systems Division, Argonne National Laboratory, with publishing support services provided by Argonne's Information and Publishing Division.  
Art Direction/Design by Daniel F. Sarro.

 Printed on Recycled Paper

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## HEV Challenge Leaves a Legacy of Achievements



It was with pride—and regret—that we concluded the third (and final) Hybrid Electric Vehicle (HEV) Challenge in June. Just as it takes more than one year to optimize an HEV, so too, it takes several seasons to optimize an event. But with Chrysler as our host in Auburn Hills, Michigan, we certainly concluded the last competition with style, substance, and success.

From a larger perspective, we can all bask in the achievements resulting from the three HEV Challenges held during 1993-95:

- ◆ Hybrid technology is maturing—partly through student approaches that have opened our eyes to a range of scenarios not even contemplated a few years ago;
- ◆ University students have built the largest fleet of hybrid-electric vehicles anywhere in the world; and
- ◆ Hybrids are beginning to take their place as part of the vehicle mix of the future. This place has been won, in part, because of the records set by HEV Challengers and the attention they brought to hybrid technology. For instance, California has approved partial zero emission vehicle (ZEV) credits for hybrids.

Although much credit can be collectively bestowed among the competition participants, many individual achievements also deserve recognition. For example, the University of Tennessee's vehicle is the first HEV Challenger to qualify as an Ultra-Low-Emission Vehicle. (See articles on pp. 1 and 5.) And, École de Technologie Supérieure reached an impressive 42 mpg (gasoline equivalent, adjusted for electrical energy usage) with its Saturn SL2.

As each competition ended this year, it became more and more apparent that the reasons each school, contributor, and sponsor participated are very different. Each of us has his own specific objectives and goals; however, it is only when they come together that we can produce a successful event. That is why we offer a menu of events with enough variation so that most schools and sponsors can receive the right combination of benefits for them.

In 1996, funding will be very tight and the need for enthusiastic sponsors even more critical. Even so, to fulfill the needs of the schools, DOE will sponsor at least three competitions:

- ◆ The American Tour de Sol, offering a separate class for Neon HEVs and opportunities for ground-up, Escort, and Saturn HEVs;
- ◆ A Propane Vehicle Challenge, requiring students to convert a 1996 Chrysler minivan to dedicated propane operation; and
- ◆ The FutureCar Challenge, an adjunct to the Partnership for a New Generation of Vehicles, designed to produce a vehicle that approaches 80 mpg.

**We hope to see you in one of these events!**

Shelley Launey  
Manager of Vehicle Competitions  
DOE Office of Transportation  
Technologies



# Industry Support Crucial to Future Competitions

Intimate knowledge of alternative-fueled vehicle (AFV) design, operation, and application. Plenty of practical experience. A solid shot at prime engineering jobs in

the future. Education gained by working with a talented team of colleagues and mentors. These are just a few of the rewards students receive from participating in the

SPONSORS	
<p><b>Gold</b></p> <p>DETROIT EDISON FORD MOTOR COMPANY GENERAL MOTORS CORPORATION SATURN CORPORATION UNIQUE MOBILITY</p>	<p><b>Bronze</b></p> <p>AMERICAN YAZAKI CORPORATION CONSUMERS POWER HURRICANE COMPRESSORS SEKELY INDUSTRIES, INC. SUN COMPANY CORPORATION WALBRO AUTOMOTIVE CORPORATION</p>
<p><b>Silver</b></p> <p>BRIDGESTONE/FIRESTONE INC. GOODYEAR TIRE &amp; RUBBER COMPANY McKENNA INDUSTRIES SIEMENS AUTOMOTIVE</p>	<p><b>Associate</b></p> <p>ALLIED SIGNAL AUTOMOTIVE COLTEC INDUSTRIES - HOLLY AUTOMOTIVE DIV. LEAR SEATING CORPORATION NSK CORPORATION SHEREX / OPW INC. SIEGEL-ROBERTS, INC. TEXTRON AUTOMOTIVE COMPANY TOPY CORPORATION UNITED TECHNOLOGIES AUTOMOTIVE, INC.</p>

Tom Gross, Deputy Assistant Secretary, DOE Office of Transportation Technologies, speaks at '95 HEV Challenge.



Transportation Technology Competitions sponsored by the U.S. Department of Energy (DOE), auto industry manufacturers and suppliers, and utilities.

Immediate access to new ideas and AFV technological innovations. The opportunity to test and evaluate advanced automotive products. Students destined to become tomorrow's outstanding engineering employees. Favorable corporate visibility. Such are the advantages industry sponsors enjoy from participating in the competitions.

All these benefits add up to top value at low cost for all involved. In 1995, nearly 300 teams from high schools, colleges, universities, and private-sector companies entered vehicles. The competitions represent a unique, cooperative arrangement involving schools, auto industry manufacturers and suppliers, and government. These competitions are a promising paradigm for a new relationship between government and industry. Without commitment and funding from DOE and know-how from Argonne National Laboratory, many of these competitions would not have been as successful. In fact, some might never have occurred at all.

However, with federal budgets declining, industry support for the competitions is more important than ever. We are hopeful that our past investments and successes in student vehicle competitions will produce new sponsors for future events. If you are in a position to assist in ongoing or future competitions, please contact me at Argonne National Laboratory, 9700 S. Cass Ave., Bldg. 362/B209, Argonne, IL 60439-4815 (Fax: 708/252-3443).

*Bob Larsen*

Bob Larsen  
Director, Competition Activities  
Argonne National Laboratory

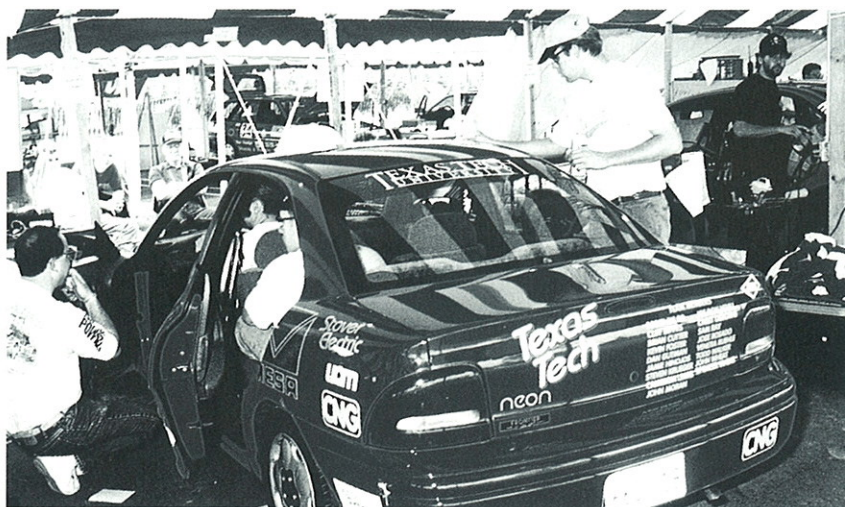


## Chrysler Neon Hybrid-Electric Vehicles Debut at 1995 HEV Challenge

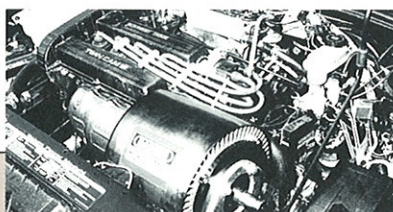
**C**hrysler Neons modified for hybrid-electric operation debuted at the third and final Hybrid Electric Vehicle (HEV) Challenge on June 5-13. The Neons joined Ford Escort wagons and Saturn SL2 sedans in the competition, which was held at the Chrysler Technology Center in Auburn Hills, Michigan. The HEVs were designed and built by 29 teams comprised of 600 students from universities across North America. (Also see "DOE Report" on p. 2.)

All vehicles entered in the HEV Challenge operated on both an electric motor powered by batteries and a combustion engine powered by methanol, ethanol, reformulated gasoline, or (Neons only) compressed natural gas. The HEVs competed in events that measured acceleration, consumer acceptability, emissions, fuel economy, range, and vehicle handling, as well as engineering design through technical reports and presentations.

The Neon Class also participated in a heating, ventilation, and cooling



event in which the vehicles were evaluated on how much energy they used and how quickly they reached a target temperature. Typically, the Neons used less energy than a conventional vehicle



but took longer to achieve the target temperature.

Student teams incorporated advanced automotive technology into the converted vehicles by implementing engine heat storage devices, Hughes induction chargers, fuel-injection systems with closed-loop emission control systems (custom-modified to the vehicle), electronically heated catalysts, advanced electric motors/controllers, prototype compressed natural gas fuel injectors, and experimental low-rolling resistance tires. Enhanced battery technologies used in the vehicles included Horizon's advanced lead-acid and Ovonic's nickel-metal hydride batteries. The HEV Challenge was cosponsored by the U.S. Department of Energy (DOE), Argonne National Laboratory, National Renewable Energy Laboratory, Chrysler Corp., and Natural Resources Canada. Other sponsors playing a major role in supporting the competition included Detroit Edison, Goodyear, Firestone/Bridgestone, Unique Mobility, and the Society of Automotive Engineers.

Complete competition results are available on the DOE Home Page, World Wide Web, under "News, Events, & Hot Topics" (<http://www.eren.doe.gov>). Also see the Argonne Home Page (<http://www.anl.gov>).

## Unique Mobility Drive Systems and Alternators "Empower" Winning Vehicles

The vehicles that "grabbed the gold" by placing first in each class at the 1995 Hybrid Electric Vehicle Challenge used Unique Mobility, Inc., permanent magnet traction drive systems and alternators. Since 1990, Unique Mobility has successfully supported university competitions, both nationally and internationally, with advanced electric vehicle traction drive systems and alternators for electric and hybrid-electric competitions. Vehicles competing in the American Tour de Sol road rally have also used Unique's components.

"Student competitions provide an informal apprenticeship program for collegiate engineering training," says Kevin Barnes, Manager of Product Sales and Applications at Unique Mobility. "The competitions challenge students to conceive, design, procure, finance, manufacture, enter into competition, and maintain vehicles with the most advanced technologies. This experience provides them with a launching point to directly contribute to the automotive designs of the future."

He contends, "These students can literally 'hit the ground running' when they enter the workforce. This is exactly what industry is seeking in new engineers."



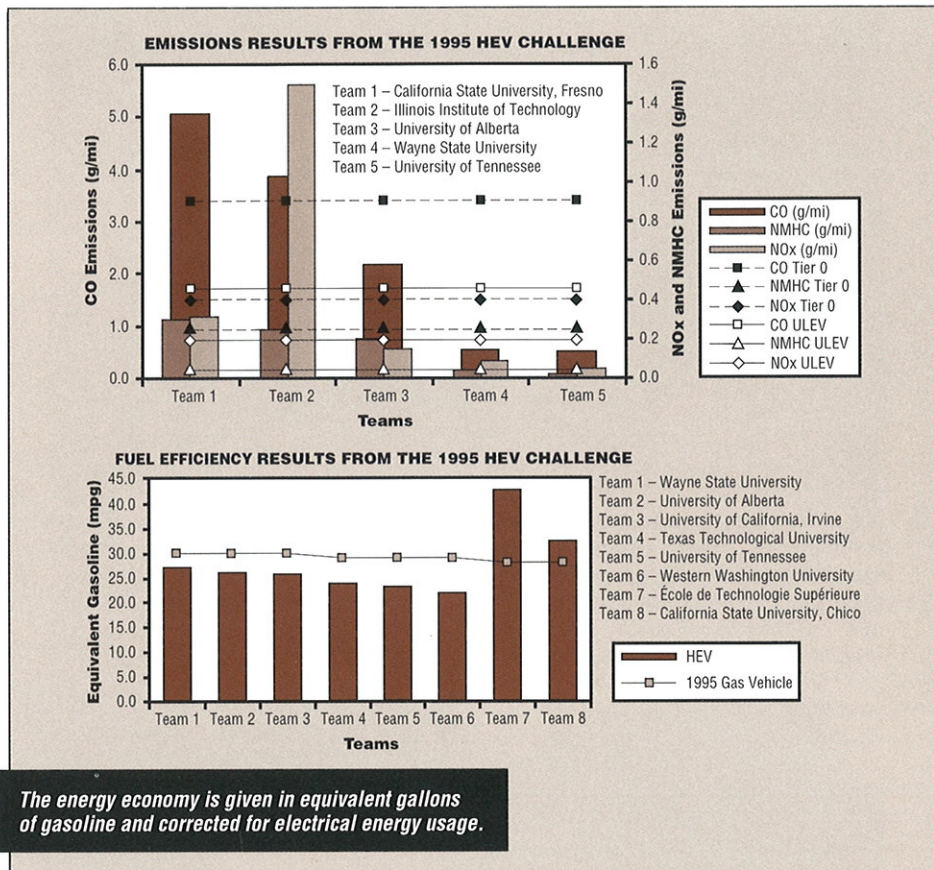
## COMPETITION RESULTS

# HEV Challenge Vehicles Exceed Standards in Energy Economy and Emissions

The test results are frequently overlooked after the competitions are over. Engineers at Argonne National Laboratory analyze the data from the competitions and present the results at conferences and in journals during the "off season."

The 1995 Hybrid Electric Vehicle (HEV) Challenge produced several vehicles that logged noteworthy results during the energy economy and emissions events. Both tests were run on dynamometers at Chrysler, Ford, and General Motors test facilities. Because of the significantly different control strategies on each vehicle, each test was conducted in a slightly different way.

The accompanying charts show the top vehicles of the two events, along with U.S. Environmental Protection Agency (EPA) fuel economy information for 1995 conventional vehicles and emissions standards. The University of Tennessee produced the most impressive result of the HEV Challenge by exceeding Ultra-Low Emissions Vehicle (ULEV) standards. Wayne State and University of Alberta also achieved results better than today's emissions standards (Tier 0). The Saturn Class performed the best during the energy economy event when



compared with its conventional vehicle counterpart. Finally, École de Technologie Supérieure had an

impressive overall energy economy of 42 mpg (gasoline equivalent, adjusted for electrical energy usage).

## 1995 HEV Challenge Awards Summary



Vehicle Class	Escort	Neon	Saturn
Overall Best	University of Alberta	University of Tennessee	California State University, Fresno
Second	Wayne State University	Texas Tech University	École de Technologie Supérieure
Third	University of Wisconsin, Madison	Western Washington University	California State University, Chico
Best Dynamometer Energy Efficiency	Wayne State University	Texas Tech University	École de Technologie Supérieure
Best Track Range	University of Alberta	Western Washington University	California State University, Fresno
Best Emissions Performance	Wayne State University	University of Tennessee	California State University, Fresno, and Illinois Institute of Technology (Tie)



## AFVs Give Outstanding Performances at DOE/CARR/DASH Competitions

**M**ore than 40 electric, hybrid, and alternative-fueled vehicles participated in the U.S. Department of Energy (DOE) Clean Air Road Rally (DOECARR), whose route took competitors across the Los Angeles basin in California from March 30 through April 1. This alternative-transportation competition consisted of four events: acceleration, autocross, rally, and range. DOE was the title sponsor of the competition; the International Electric Grand Prix Association (IEGPA) was the organizer.

DOECARR included vehicles and buses fueled by electricity, methanol, ethanol, natural gas, and other alternative fuels. An electric vehicle (the Endura), converted by the University of California, Davis, delivered the most impressive performance by traveling 134 miles on one charge, using a zinc-flow

battery. As an added bonus, DOE Assistant Secretary of Energy Christine Ervin spoke at the start of the DOECARR rally. She also acted as navigator of the University of California, Davis, hybrid vehicle during part of the rally.

In conjunction with DOECARR, eight student-built, ground-up hybrid-electric vehicles (HEVs) participated in a separate competition, the DOE Advanced Student Hybrid (DASH) Challenge. (These vehicles were competitors in the 1993 and 1994 Hybrid Electric Vehicle Challenges.) The HEVs were evaluated for their emissions, energy efficiency, consumer acceptance, and technical design. The DASH Challenge was cosponsored by DOE, supported by the California Air Resources Board (CARB), and organized by Argonne National Laboratory. (See sidebar on p. 7

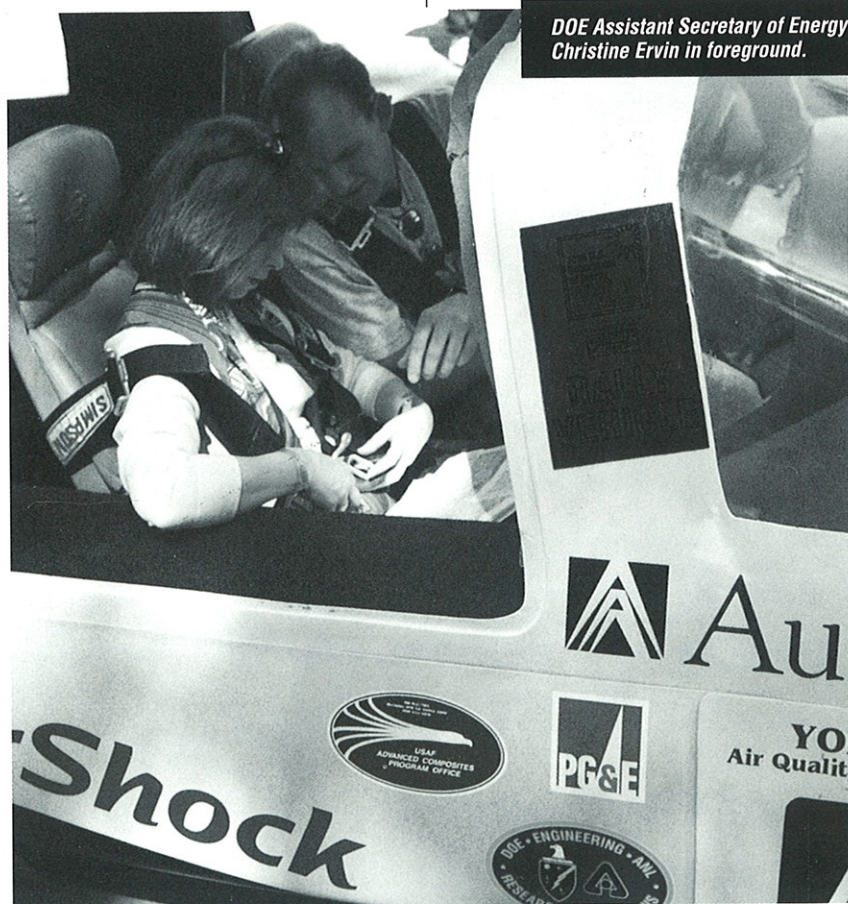
for top three finishers in each competition and class.)

Before the start of the DOECARR, DASH vehicles went through emissions testing by CARB in El Monte, California. Previously, some of the purpose-built HEVs had achieved near Ultra-Low Vehicle Emissions (ULEV) standards, but unfortunately, only Michigan State University was able to achieve Tier 0 (current) standards during this year's competition. After participating in the emissions and consumer acceptance events, the DASH vehicles competed in the acceleration, autocross, rally, and range events, along with the other DOECARR vehicles.

During one day of the rally and range events, the energy economy of the DASH vehicles was measured. The overwhelming winner of the energy economy event was an HEV from the University of California, Davis. The vehicle traveled 83 miles without using any gasoline and consuming only 9.8 kWh of electrical energy. Cornell University's Tempest finished second, using compressed natural gas as a fuel (1.5 equivalent gallons of gasoline) and 5.8 kWh of electricity.

The DASH teams also participated in a demonstration at four junior high schools in Orange County and Los Angeles, California. At these schools, representatives from DOE, Argonne National Laboratory, and the teams gave presentations to the students on advanced transportation technologies and energy. In addition, several junior high students were selected to ride in the hybrid vehicles. This event was covered prominently in the *Los Angeles Times*. Overall, public and media reactions were excellent for both the DOECARR and DASH competitions. More than 50 media representatives visited the competitions, including 9 television reporters.

Spencer Quong  
Engineer  
Argonne National Laboratory



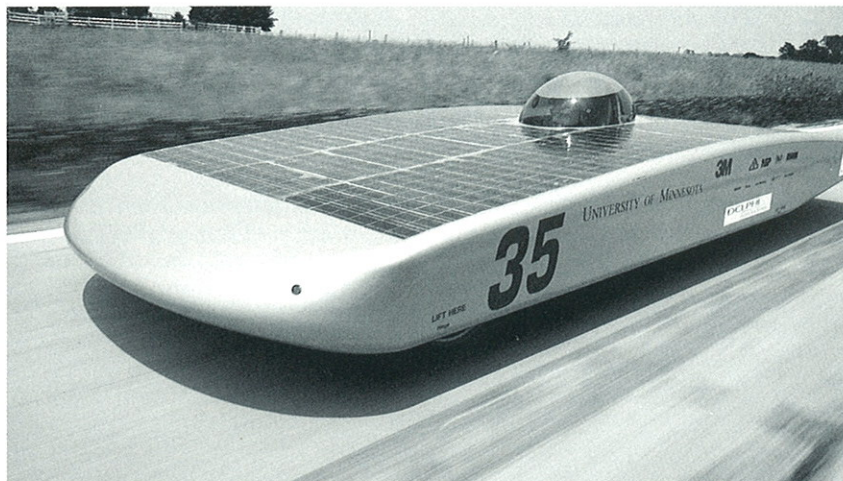
DOE Assistant Secretary of Energy Christine Ervin in foreground.



## University of Minnesota Sets Single-Day Record of Over 50 mph at Sunrayce 95

**A**fter 1,150 miles and nine days of racing, the Massachusetts Institute of Technology (MIT) finished first in Sunrayce 95, just 18 minutes in front of second-place University of Minnesota, the closest Sunrayce finish ever. Cal Poly Pomona placed third in the competition. Sunrayce is a biennial collegiate solar car race; this year, it was sponsored by the U.S. Department of Energy (DOE) through the National Renewable Energy Laboratory and General Motors Corp. Sunrayce 95 began in Indianapolis, Indiana, on June 20 and finished in Golden, Colorado, on June 29.

MIT took the overall lead from Cal Poly Pomona on the second day of



racing and never relinquished it, averaging a record 37.23 mph

for the entire race distance. (In comparison, Michigan's winning average speed in 1993 was 27.29 mph.) MIT withstood strong challenges from several teams, but the biggest challenge came on the final day when rain slowed the team, presenting Minnesota with an unexpected chance to win the race. However, MIT's "Manta" had just enough stored energy to hold off the surprising Minnesota team over the final 52-mile leg from Aurora to Golden, Colorado.

On Day 7, from Smith Center, Kansas, to St. Francis, Kansas (163 miles), the University of Minnesota finished first and shattered the existing, single-day record of 43 mph average speed by averaging just over 50 mph. Many teams were capable of maintaining the 55-mph speed limit, creating the fastest Sunrayce ever.

A new location and communication system ensured that race officials received up-to-the-minute information on each team's status and location throughout Sunrayce 95. The system was developed by Electronic Data Systems, Hughes Network Systems, and Delco Electronics.

For more information on Sunrayce 95 or the upcoming '97 competition, contact Sunrayce Headquarters at (303) 384-6735; E-mail: sunrayce@nrel.gov.

## Top Winners in 1995 DOECARR

### Alternative-Fueled Vehicles

- ◆ 1st Long Beach Gas Dept. (Dodge CNG minivan)
- ◆ 2nd Southern California Gas Co. (CNG Honda Civic)
- ◆ 3rd Long Beach Gas Dept. (CNG police car)

### Buses/Trucks

- ◆ 1st Long Beach Gas Dept. (CNG meter truck)
- ◆ 2nd Sunline Transit Agency (CNG Orion bus)
- ◆ 3rd Long Beach Gas Dept. (CNG refuse truck)

### Electric Vehicles

- ◆ 1st University of California, Davis (Geo Prism)
- ◆ 2nd Little Guy Racing Co. (Geo Metro)
- ◆ 3rd MendoMotive (Porsche 550 Spyder)

### Student Electric Vehicles

- ◆ 1st Central High School (Volkswagen Rabbit)
- ◆ 2nd South Mountain High School (AMC Jeep)
- ◆ 3rd California State University, Long Beach (Porsche 914)

### Hybrid-Electric Vehicles (HEVs)

- ◆ 1st New York Institute of Technology Gasoline Hybrid (purpose-built)
- ◆ 2nd Cornell University Hybrid (purpose-built CNG)
- ◆ 3rd University of California, Santa Barbara Ethanol Hybrid (purpose-built)

## 1995 DASH Challenge Winners

### Student-Built, Ground-Up HEVs

- ◆ 1st University of California, Davis
- ◆ 2nd Cornell University
- ◆ 3rd New York Institute of Technology



# Electric Vehicles Proven Nearly Twice as Efficient as Gasoline Counterparts at American Tour de Sol

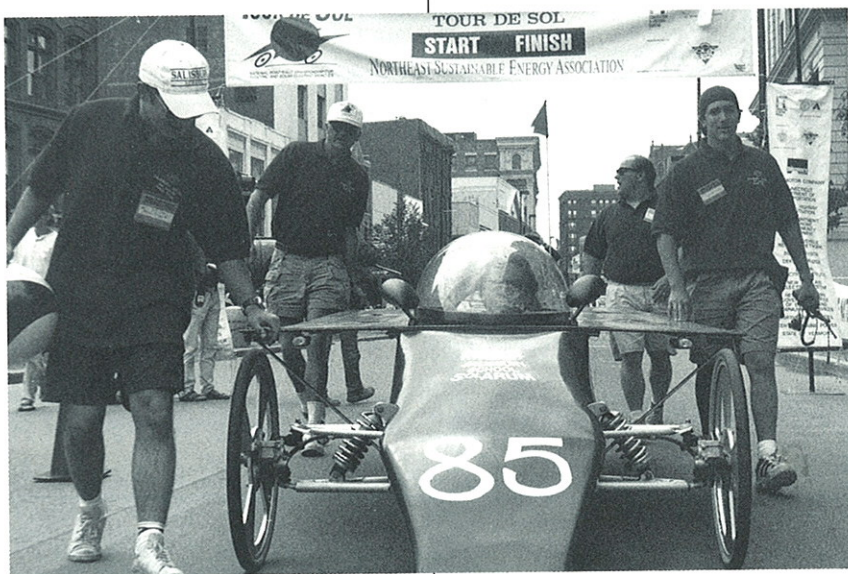
In a unique arrangement, gasoline- and electric-powered cars operated side by side in real-world conditions—and the electric cars ran away with the efficiency prize at the May 20-27 American Tour de Sol (ATdS) national road rally for electric and solar vehicles. Electric vehicles demonstrated that they were

almost twice as energy-efficient as their gasoline counterparts. The results also indicated that hybrids (combination electric/gasoline vehicles) are making advancements in energy efficiency.

With assistance from the U.S. Department of Energy (DOE), Argonne National Laboratory, and

the Electric Vehicle Research Network, the Northeast Sustainable Energy Association (NESEA), coordinator of the ATdS, collected data during the ATdS electric vehicle rally. During that event, four dozen vehicles—electric, solar-powered, and hybrids—traveled more than 300 miles through the Northeast. They were joined by a “control” car, a top-mileage 1995 Geo Metro sedan, produced in the United States, provided and driven by Argonne National Laboratory staff. The gasoline-powered Metro traveled 35.8 miles per equivalent gallon, while another Geo Metro, converted to electric power by Solectria Corp. in Massachusetts, turned in an impressive 65.2 miles per equivalent gallons of gasoline.

NESEA converted kilowatt hours of electricity to equivalent gasoline miles per gallon (mpg) using a 51% power plant efficiency, 7.5% electrical transmission losses, and 32.2 kWh per gallon of gasoline. No power plant fuel and gasoline production and distribution losses were included. The high power plant efficiency was derived from





a state-of-the-art, combined-cycle power plant. A modern power plant was used because the gasoline control vehicle (the 1995 Geo Metro) is one of the most fuel-efficient vehicles available today. If a 33% power plant efficiency were used, the equivalent gasoline mpg of the electric vehicle would be approximately 42.1 mpg. "This is the first time anyone has done a head-to-head test like this," notes Nancy Hazard, ATdS Director at NESEA. "We now know the electric cars make sense for energy conservation as well as for environmental quality."

The top performer in the entire ATdS rally was a four-seater, preproduction prototype vehicle called the Sunrise, which was also built by Solectria. The Sunrise won the first annual NESEA Energy Challenge award, which was offered for the most efficient vehicle in each of four categories: two-seater and four-seater sedans, utility vehicles (truck or van), and motorcycles. (See article on p. 1.)

Now in its seventh year, the ATdS rally stopped in nine communities en route from Waterbury, Connecticut, to Portland, Maine, attracting over 45,000 spectators. Major sponsors of the 1995 road rally included DOE, the Waterbury (Connecticut) Region Convention and Visitors Bureau, the Massachusetts Department of Transportation, the Federal Highway Administration, the Maine Solar Blast, and the Discovery Channel. (See accompanying sidebar for ATdS results.)

In 1996, NESEA plans to conduct a New York City to Washington, D.C., event. (For complete details, see Calendar on p. 12.) Electric vehicles built by the major car companies to meet clean air mandates in Massachusetts, New York, and California are expected to participate. NESEA also intends to collect energy-use data from more hybrid vehicles, as well as from electric vehicles powered by batteries, fuel cells, and flywheels.

If interested in participating in the 1996 ATdS, please contact NESEA, 50 Miles St., Greenfield, MA 01301. Phone: (413) 774-6051; Fax: (413) 774-6053.

## 1995 American Tour de Sol Results

### *Production Category (Vehicles on the market)*

- ◆ 1st Solectria ForceGT  
Virginia Power/Solectria Corp.  
Arlington, MA
- ◆ 2nd Ford Ecostar  
Northeast Utilities  
Hartford, CT
- ◆ 3rd Nordic Challenger (Solectria Force)  
EVERmont/NAVC  
Waterbury, VT

### *Discovery Channel Commuter Category*

*(Practical 2- and 4-seater sedans and utility vehicles not on the market)*

- ◆ 1st Solectria Sunrise  
Boston Edison/NAVC  
Boston, MA
- ◆ 2nd Solar Bolt (Fiat Conversion)  
Bolton High School  
Bolton, CT
- ◆ 3rd Genesis I (Dodge Pickup)  
Genesis Team  
Saginaw, MI

### *Hybrid Category (Propane, hybrid-electric vehicles)*

- ◆ 1st Project e-  
Mt. Everett High School  
Sheffield, MA
- ◆ 2nd Tempest  
Cornell HEV  
Ithaca, NY
- ◆ 3rd Ecovox  
Dartmouth Solar Racing  
Hanover, NH

### *Solar Racing Category*

*(Batteries recharged only from solar cells on the car)*

#### *Tour de Sol Racing*

- ◆ 1st Photon  
Salisbury School  
Salisbury, CT

#### *Cross-Continental Racing*

- ◆ 1st Spirit of Massachusetts  
University of Massachusetts  
Lowell, MA

### *Open Category*

*(Vehicles that don't fit in other categories, including motorcycles and one-person, 2- to 4-wheeled vehicles)*

- ◆ 1st ERANGE  
Schiller Group  
Germany
- ◆ 2nd Sunpacer  
Cato-Meridian High School  
Cato, NY
- ◆ 3rd Hopper EV  
Tom Hopper  
Concord, NH

### *Gasoline Control Vehicle*

Gasoline Control Car (Geo Metro)  
DOE/Argonne National Laboratory  
Argonne, IL





## Competitions Showcase Strides Made in Electric Vehicle Technology



Over the past six months, several competitions supported by the U.S. Department of Energy (DOE) and organized by Electric Vehicle Technology Competitions (EVTC) of Phoenix, Arizona, have showcased electric vehicles built by high school and college students. In the *APS Electrics*, held March 3-5 in Phoenix, top high school teams placing in the Student Electric Competition included Electric Cars of Roanoke Valley (representing four high schools), North Carolina (first); Port Townsend #50, Washington (second); and Kearny High School, California (third). This event was held at the Firebird International Raceway near Phoenix. (See p. 11 sidebar for other winners.)

In the *Richmond EV Grand Prix*, held May 5-6 in Richmond, Virginia, 19 high schools and 8 universities from across the United States entered vehicles. Along with a High School Student Electric Competition that allowed students to compete against each other in acceleration, design, braking and handling, range, and oral presentation, a High



School Feature Race and the Asea Brown Boveri (ABB) University Spec Series Feature Race were held. Electric Cars of Roanoke Valley of North Carolina again took the overall first-place position in the

Student Electric Competition, leading in braking and handling as well as range. Other winners were Chesapeake High School in acceleration, Hermitage Technical Center in design, and Central Shenandoah Valley School in the oral competition.

## Electra Challenge Spotlights High School Electrics

Five high school teams participated in the Electra Challenge, a high school electric vehicle competition that debuted on April 6-9 at the Charlotte Motor Speedway in Charlotte, North Carolina. The competition was conducted as part of the Champion Spark Plug Auto Fair. The Fair drew approximately 130,000 people, providing wide exposure of electric vehicles to auto enthusiasts.

Five events—acceleration, efficiency, handling, design, and oral presentation—were conducted at the Electra Challenge. (No racing was done.) A.R. Burton Technology Center, Roanoke, Virginia, finished first overall by winning three of the five events (acceleration, handling,

and oral presentation). The four remaining teams also took home prize money.

Duke Power organized and staffed the Electra Challenge very economically as a spinoff of last year's EV Grand Prix held in Richmond, Virginia. Cosponsors included the U.S. Department of Energy (DOE), Appalachian Power, Charlotte Speedway, and York Technical Institute. Argonne National Laboratory assisted with technical support and inspection of the vehicles. The Edison Electric Institute also contributed to the competition.

For more information about the '96 competition, contact Tim Shawver, Duke Power. Fax: (704) 382-4338.

The winner of the 35-lap High School Challenge Series Feature Race was Gloucester High School of Gloucester, Virginia. In the 50-lap ABB University Spec Series Feature Race, the first-place spot was claimed by Case Western Reserve University of Cleveland, Ohio.

"Teams have shown significant improvement all year," observes Don Karner, President of EVTC. "At this final event, the cars were faster, the pit crews quicker, and the teamwork exceptional. The entire weekend highlighted the strides being made in the electric vehicle arena."

For more information about these or upcoming electric vehicle competitions, contact Don Karner, EVTC, 401 S. Second Ave., Phoenix, AZ 85003. Phone: (602) 256-2599; Fax: (602) 256-2606.



## First-Place Winners in APS Electrics

### High School Feature Race

Port Townsend High School  
Port Townsend, WA

### High School "A" Heat Race

Port Townsend High School  
Port Townsend, WA

### High School "B" Heat Race

Cortez High School  
Phoenix, AZ

### Formula E University Spec Feature Race

Brawner Motorsports, Inc.  
Phoenix, AZ

### Super Stock/Street Stock Feature Race

University of California, Davis  
Davis, CA

### Hybrid Feature Race

University of Wisconsin-Madison  
Madison, WI

### Hybrid Heat Race

GMI Engineering and  
Management Institute  
Flint, MI

## Top High School Winners in Events

### Overall Winners

- ◆ 1st North Halifax County High School, Halifax, NC (\$500 purse)
- ◆ 2nd Port Townsend High School #60, Port Townsend, WA (\$400 purse)
- ◆ 3rd Kearny High School, San Diego, CA (\$300 purse)

### Oral Presentation

- ◆ 1st Marian Academy, Rexdale, Ontario, Canada
- ◆ 2nd North Halifax County High School, Halifax, NC
- ◆ 3rd Northampton County High School, Conway, NC

### Design

- ◆ 1st North Halifax County High School, Halifax, NC
- ◆ 2nd Port Townsend High School #60, Port Townsend, WA
- ◆ 3rd Marian Academy, Rexdale, Ontario, Canada

### Acceleration Time

- ◆ 1st Port Townsend High School #60, Port Townsend, WA
- ◆ 2nd East Valley Institute of Technology, Mesa, AZ
- ◆ 3rd Coronado High School, Coronado, CA

### Handling and Braking

- ◆ 1st Shadow Mountain High School, Phoenix, AZ
- ◆ 2nd Palo Verde High School, Tucson, AZ  
and  
North Halifax County High School, Halifax, NC (Tie for 2nd Place)

### Range

- ◆ 1st Shadow Mountain High School, Phoenix, AZ
- ◆ 2nd Kearny High School, San Diego, CA
- ◆ 3rd Palo Verde High School, Tucson, AZ

## Methanol (M-85) Class Vehicles Excel

The Society of Automotive Engineers (SAE) conducted two U.S. Department of Energy (DOE)-supported Transportation Technology Competitions this year: the 1995 Formula SAE, held May 18-21 in the Pontiac Silverdome parking lot in Michigan, and the 1995 SAE/AAA West Coast Supermileage, held June 10-11 in Sacramento, California.

A total of 84 formula-style racing cars competed in the Formula SAE. Thirteen vehicles took part in the Methanol (M-85) Class, sponsored by DOE and administered by Argonne National Laboratory. The vehicles that participated in the Methanol Class were eligible for Best M-85 Design/Conversion, Best Fuel Economy, and Outstanding Teamwork awards.

The University of Texas-Arlington triumphed as a triple winner. The team placed first overall in the competition, one of several times an alternative-fueled vehicle has won the Formula SAE title. It also secured first place in the M-85 category and received the award for Best M-85 Design/Conversion.

The other top M-85 winners were the University of Akron #16 (second place) and University of Akron #13 (third place). The University of Akron #16 was presented with the award for Best M-85 Fuel Economy, while Santa Clara University was honored with the Outstanding Teamwork award, provided by DOE.

In the West Coast Supermileage, five of the 15 competing vehicles participated in the Methanol Class.

M-85 winners were Sierra College (first place), California State University-Sacramento (second place), and California State University-Fresno (third place).

For more information, contact Lynn Puskar at SAE headquarters. Phone: (412) 776-4841, ext. 224; Fax: (412) 776-1615.



## Upcoming 1996 Transportation Technology Competitions

### March 1-3

**APS Electrics**  
Electric vehicle competition  
Phoenix, Arizona

♦ **Contact:**  
Donald Karner  
Electric Vehicle Technology  
Competitions, L.C.  
Phone: (602) 256-2599  
Fax: (602) 256-2606

### May 10-17

**8th Annual American Tour de Sol**  
Road rally championship  
for electric and solar cars  
New York to Washington, D.C.

♦ **Contact:**  
Northeast Sustainable  
Energy Association  
Phone: (413) 774-6051  
Fax: (413) 774-6053

### May 28-June 5

**Propane Vehicle Challenge**  
Propane competition  
based on '96 Chrysler minivans  
Windsor, Canada (5/28-6/3), and  
Toronto, Canada (6/4-6/5)

♦ **Contact:**  
Shelley Launey  
U.S. Department of Energy  
Fax: (202) 586-9815  
E-mail: shelly.launey@hq.doe.gov

### June 10-16 (tentative date)

**FutureCar Challenge**  
Conversion of mid-sized production  
vehicles from "Big Three"  
automakers  
Dearborn, Michigan

♦ **Contact:**  
Shelley Launey  
U. S. Department of Energy  
Fax: (202) 586-9815  
E-mail: shelly.launey@hq.doe.gov

### June 8-9

**West Coast Supermileage**  
One-person, alternative-fueled  
and gasoline vehicles  
Sacramento, California

♦ **Contact:**  
Lynn Puskar  
Phone: (412) 776-4841, ext. 224  
Fax: (412) 776-1615

### June 21-22

**Cleveland Electric  
Formula Classic**  
Open-wheeled electric race cars  
Cleveland, Ohio

♦ **Contact:**  
Donald Karner  
Electric Vehicle Technology  
Competitions, L.C.  
Phone: (602) 256-2599  
Fax: (602) 256-2606

Please keep us informed of any changes in names or  
addresses for the FutureDrive mailing list so we can ensure  
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