EEVC NEWSLETTER

Published by the Eastern Electric Vehicle Club

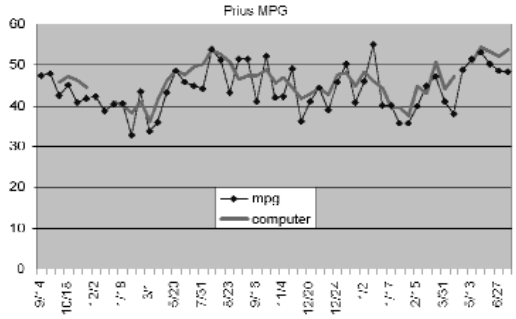
Peter Cleaveland, Editor
Club Address: P.O. Box 134, Valley Forge, PA 19481-0134
email easternev@aol.com
President: Oliver Perry, 5 Old Stagecoach Turn
Shamong, NJ 08088, (609) 268-0944

Vol 24 No 8
AUGUST, 2004

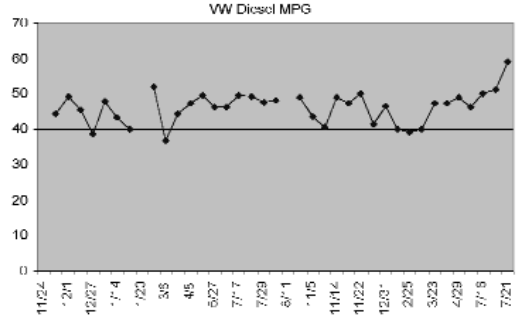
Now affiliated with EAA

BEST KEPT SECRET FOR A PETROLEUM INDEPENDENT FUTURE

Ron Groening



Prius fuel mileage



VW turbodiesel fuel mileage

I'm in a line of cars creeping slowly up a hill to an intersection in the silent "stealth" mode with the electric motor, only. Then I step on the accelerator to move faster and the gasoline engine starts and engages in order to aid the electric motor. I love my Prius because among the hybrid choices, it is the closest to an EV.

In the Fall of 2002, we replaced two aging VW Jetta diesels by a 2002 Prius and a 2003 VW Jetta diesel station wagon. We purchased the Prius for $22,000 and the VW for $21,000. At about 2800 pounds, the Prius is about 200 pounds lighter than the VW. The Prius being gasoline/electric and the VW being diesel makes them vastly different approaches to fuel efficiency. Both have equally efficient pedigrees that put their advertised mpg estimates into the 40 to 50 mpg range. Their mpg performances top all the other cars in the marketplace. I decided to keep careful records of fuel consumption and compare their mpg performance directly.

We drive both cars similarly (I the Prius and my wife the VW). Most usage is local short trips and occasional usage is long trips. We attempt to keep the mileages about the same through usage for long family trips. The comparative utilities are quite different. The Prius is roomy for passengers but luggage space is limited while the VW, being a station wagon, has more luggage space and less room for passenger comfort.

Calculations from the fuel consumption records indicate that the overall mpg at

about 20 and 19 thousand miles, respectively, is 44.2 for the Prius and 46.3 for the VW. That a turbo-diesel can outperform a gasoline hybrid is the "best kept secret". The Prius is designed to maximize the efficiency of the gasoline engine by using batteries and electric motors to share the mechanical energy while the VW has a turbo-diesel engine.

The efficiency advantage of the diesel is probably its inherent fuel energy content. Diesel fuel has a theoretical energy advantage over gasoline, all other things being equal. Gasoline combustion is a constant-volume process characterized by spark-ignition or Otto cycle. Diesel combustion is a constant-pressure process characterized by slow-speed compression-ignition or Diesel cycle. The high heat value at constant volume for gasoline is 124,800 Btu per gallon while the low heat value at constant pressure for kerosene (diesel) is 127,300 Btu per gallon. On the other hand, the high heat values for gasoline and kerosene in a bomb explosion, are 20,750 and 19,810, respectively. These numbers and explanations are from Marke's Standard Handbook for Mechanical Engineers Seventh Edition.

For EV aficionados, the Toyota Prius has the makings of the ultimate EV, that is, an EV with a "backup" gasoline engine that could be used when batteries are discharged or for long trips. A "plug in" Toyota Prius with a more substantial battery pack could be the first ultimate EV. It would draw power from the grid that could be solar, hydro-electric, wind, or nuclear. Those are all non-petroleum energy resources. However, the "backup" gasoline engine would still depend on petroleum.

The turbo-diesel is a unique family of internal combustion engines that includes those that can burn "alternate" non-petroleum fuels, ultimately consisting of vegetable oils derived from farm crops. This kind of engine would be efficient as the sole power or hybrid power for an automobile.

Both vehicles are leading the way to independence from petroleum, the "hydrogen economy" notwithstanding. The Toyota Prius is gaining public acceptance of the EV while the turbo-diesel is the first step toward alternative fuels.

This direction for a petroleum-independent future is toward an agricultural solution where farmers' crops are the oil energy source for internal combustion engines and power utilities fed by solar, hydro-electric, wind, or nuclear provide energy for plug-in electric vehicles.

There are "rough edges" about this non-petroleum future of alternative-fuel cars using turbo-diesel engines and diesel-hybrid electric vehicles. Ultimately, public acceptance is required. Developers of non-petroleum alternative fuels will have to address pollution concerns that the public has about diesel fuel. Developers of electric vehicles must make an intelligent, foolproof, fuel/battery management system that is "invisible" to the EV operator.

Yet, even today, there is evidence of the petroleum-independent future. Gasoline hybrids and fuel efficient turbo-diesel engine cars are available and on the road today. Buses and trucks use diesel fuel. Trains, subways, and trolley cars use electricity. By these examples, the public observes and benefits from the technology approaches that could enable a petroleum independent future.

Movement toward a petroleum independent future requires leadership and education to counter the petroleum and automobile industries that are both manipulating and responding to public consumer practices. High fuel prices put high premiums on fuel efficient cars and remind everyone of the importance of moving toward a petroleum independent future. Driving a hybrid and turbo-diesel automobiles remind everyone of the imminence of a petroleum independent future.

BATTERIES ARE BACK?
Oliver Perry

In the July issue of this newsletter our editor, Pete Cleaveland, in his article "Electric Still Beats Hydrogen," referred to a recent study conducted by the Institute for Lifecycle Environmental Assessment. The study questioned the future of the hydrogen fuel cell vehicle. When it comes to overall efficiency the report suggested that the electric vehicle might have more going for it than the hydrogen fuel cell car.

I am not sure that most of us have comprehended the significance of this report. If you only glanced over it, you might want to reread it.

Hydrogen fuel cell cars are not yet available. When and if they do become available, there is serious question as to how cost-effective they will be. The notion that the hydrogen fuel cell car is the car of the future may turn out to be false. So for those who want independence from fossil fuels, perhaps the electric car is the best answer after all.

Mike Skelly, a member of the NESEA board, told me last May in New York City (at the Tour de Sol), that a group of NESEA leaders had recently conducted a round table discussion and concluded that battery powered cars held the most promise for alternative fuel transportation, not the hybrid nor the fuel cell car. Jim Dunn, a NESEA volunteer and an engineer associated with NASA's Center for Technological Commercialization, was the strongest voice among the advocates for battery power. Dunn is also associated with Worcester Institute of Technology in Massachusetts. He champions the lithium-ion battery as a better solution than hydrogen fuel cells. Jim has had direct hands-on experience with both technologies. Rob Wills, the founder and present technical director of the American Tour de Sol, also feels that there is a definite resurgence in battery powered cars.

It is interesting that in recent years the experts have considered the hybrid car to be the practical car of the future, or at least the car of transition to the future. Will the battery powered car emerge as the ultimate winner? Advancements in battery technology are causing some to believe that this will be the case.

In the May 2004 issue of the *FVEAA Newsletter*, (Fox Valley Illinois) after reporting the chance of permanent steadily rising gas prices, an Editor's note states, "If you have an electric car- hold on to it."

What do we understand about batteries?

The battery is the MOST important (but one of the least understood) components in an electric car. Without a battery all of the electronics and high tech motors in the world have no value. A battery is somewhat analogous to a tank of fuel in a conventional car. Without a tank of suitable fuel a car goes nowhere. And without a charged up battery an electric car cannot move either. And this battery, like the common fuel tank, is too frequently taken for granted. Few stop to consider what really happens inside the black casing of the battery. We are getting used to seeing many "black boxes" in every mechanical and electrical item that we purchase. There are black boxes everywhere, even under the hood of an electric car. Some of these boxes are important for efficiently directing the energy in the battery to the motor. But I suggest that the most mysterious black boxes of all in electric cars are the batteries themselves. How do the chemical ingredients inside work?

Most car tinkerers never play with gasoline. Few attempt to design an improved blend to improve engine performance. We play with the parts of the vehicle that we can most easily manipulate. We rely on the chemists in the fuel companies to develop the most economical fuels while we change the spark plugs, adjust the carburetor, and vary the valve timing. And few electric car enthusiasts tinker with battery design and chemistry when they replace the controller or motor brushes. We leave our energy sources up to the petroleum and battery companies. We feel that we can experiment with motors, electrical configurations, and body design for our improvements. But, I would venture to say that most of us have been totally dependent upon the battery companies to improve battery technology. Few of us are adjusting plates and grids in our battery. Unless we work for a battery company, we don't feel comfortable opening the battery cases and poking around inside to see if we can make repairs or forward progress.

My first experience with "opened" lead acid batteries

In my senior year of high school I slipped into the darkened back room of our science lab to do some film work with radioactive materials. After I closed the door and began working, the science teacher in charge of my project yelled through the closed door, "Don't sit on the stools in there, Mr. Stinner is working on car batteries and I think there is sulfuric acid all over the place!" I was about to learn that experimenting with lead acid bat-

teries can change the appearance of one's clothing.

For some reason I had chosen to wear my best school trousers that day, no doubt to impress a few select girls. My experiment came to a quick end when I informed my instructor that I was indeed sitting on one of the stools. Within a few minutes I learned what to do when sulfuric acid ends up on clothing. Standing in my under shorts I watched as Mr. Wilbur poured sodium hydroxide over my pants to neutralize the sulfuric acid. Next my new trousers were sent to the home economics room to be washed and dried. My instructor made a comment about how sloppy Mr. Stinner was with his battery repair and then looked up at the clock. As I glanced at the opened batteries on the shelf, and saw all of the interesting "innards" for the first time in my life, I was informed that the bell was about to ring signaling the end of class. Suddenly I forgot about the interesting battery innards and I made an historic dash to the gym locker room to get my gym shorts before anyone would see me in my underwear.

I ran by the girls' home economics room just as the girls were lining up in the opened doorway to leave. I heard a few screams as I rounded the corner and flew down the stairs. I made it to the locker room with only one teacher seeing me in the hallway. He yelled something about how cute my legs were as I ran by him.

I never forgot the sight of that opened battery being repaired. A year later, after I purchased a boxed battery for my dad's car and found out (after I brought it home) that the sulfuric acid had not yet been added, I recalled my permanently stained pants and Mr. Stinner's battery repair room. I called him to find out how to add the acid and what percentage of water, if any, to include. My dad and I at that point were dependent upon the knowledge of the local high school chemistry teacher when it came to properly adding the electrolyte to his battery. The place I purchased the battery was closed.

But even though I knew batteries could be repaired (if one was willing to learn some chemistry), as I grew in my understanding of the mechanical and electrical operation of cars, I left the understanding of battery repair to Exide. We tend to purchase manuals on mechanical and electrical repair of the items we buy, but we seem to learn little about the batteries that power them.

Need for Battery Basics

Every now and then we learn of some "do it yourselfer" who, like my chemistry teacher ,dares to open up a battery to repair it. Obviously such a person has a working knowledge of how a battery works. It might be beneficial if more of us had the same understanding.

Mike Manning and Guy Davis are EEVC members who have actually worked in the battery business. Both have experience in designing and building batteries. The rest of us still could learn a great deal about battery fundamentals, and whenever we have questions regarding battery problems we go to them for suggestions.

Don Zimmerman recently drove over to Cinnaminson High School to pick up Pete Cleaveland's old moped. Don hopes to convert it into an electric hybrid. While there Don helped me load about 24 old discarded 12 volt electric car batteries into my van. Rather than take them to a recycling site I am considering repairing them. If nothing else I would like to find out exactly what went wrong with these particular batteries before I have them recycled.

As we loaded the batteries Don made the remark that he had heard that it wouldn't be good for me to store them on the concrete pad that I had at home. The concrete, Don implied, could drain them even further.

How often have we heard that a battery stored on concrete will be drained?

I don't know a whole lot about batteries but I have learned in my discussions with those who understand batteries that they are not drained by a concrete floor. I explained to Don what others had passed on to me. Temperature does affect batteries. A cool concrete floor can lower battery temperatures and thus affect battery performance. Cold batteries don't perform as well as warmer ones. (Does anyone know why?) But, electrically speaking, the plastic casing on a battery, if kept clean, insulates the electrical activities inside the battery from any conductors outside. If a steel battery box does not drain a car battery why would a less conductive concrete floor?

Don appreciated my insight on concrete floors and battery drainage. But as we moved these back breaking, electrical fuel tanks from one place to another, I couldn't help thinking how little many of us understand about how batteries produce electricity. We also wonder if they can be fixed when they go dead. If they can be, how? What are our chances of fixing something unless we understand what makes it work in the first place?

Some batteries can be fixed and others cannot be. How can we distinguish those that can from those that can't? Pulse Tech is a company that has developed instrumentation that can help in this regard, at least according to their claims. But are these claims valid? I intend to find out.

When I finished unloading the batteries, as always, my back reminded me that we have to get more energy out of them then we currently do. Man, are they heavy! Will we ever come up with a better battery? (Mike Manning if you are reading this, make that your life goal! Don't let those years you worked in Exide battery research go to waste!)

It seems to me that it might be good for us in the weeks to come to revisit battery basics and improve our understanding of battery technology, especially if the battery powered electric car is the car of the future. Let's continue to keep abreast of the latest developments in battery design and technology.

Future Meetings and Discussions Regarding Battery Fundamentals

Mike Manning acquired several discarded Horizon batteries from John Murphy, who used them in the Methacton High School three wheeler. Mike plans to use these unique advanced lead acid batteries for instructional purposes at one of our future meetings. I also have twelve of the same type.

Paul Kydd is very interested in the lithium-ion battery. He has constructed some lithium batteries for his electric boat and he is interested in attempting an electric car application. I recently read a research paper that Paul prepared which addresses the Hydrogen fuel cell economy vs. the lithium-ion battery. It is very informative. Look forward to hearing more from Paul regarding the Li-ion battery in upcoming meetings and in this newsletter. (Pete also referred to the advantages of the lithium-ion battery in the last newsletter article, "Electric still beats hydrogen".

In past meetings we have discussed the desulfating of sulfated batteries using high frequency electrical pulsing. All of us are interested in bringing dead batteries back to life. Pulsing technology is not new. However the process in some ways remains debatable. I am not sure that we have reached common agreement as to the value of the technology.

Cars of Maryland (Baltimore, MD) is an industry that reclaims and resells used and damaged cars and batteries. In 1998, CARS began using the Pulse Recovery System and a Pulse Tech Digital Battery Analyzer to check and recover dead, sulfated batteries. The analyzer was used to determine which batteries had bad cells and could not be recovered. Then they began pulsing the other batteries with the PRS system. Within one month they recovered 500 batteries.

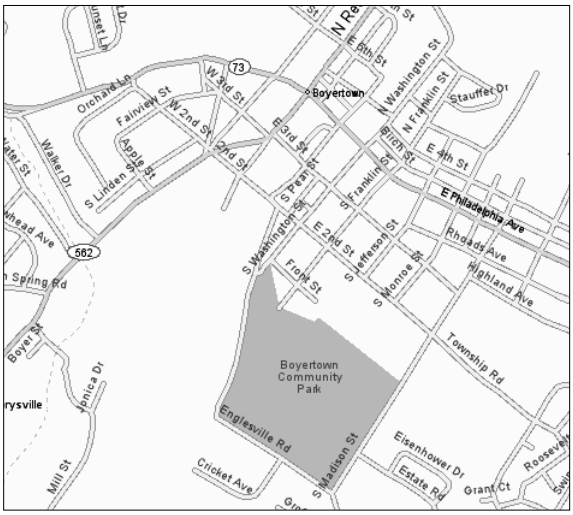
(But what about batteries with bad cells? Why did the cells go bad? Can some be repaired?)

What about sealed batteries that have lost water during charging? Can the water be replaced? Jeff Skelskie of Special Services, a distributor for Pulse Tech products, told me that he actually took the lid off a sealed battery one time and began pulse charging it. It was not doing too well. Then it began to rain. Suddenly the battery came back to life as the battery received moisture.

As I indicated above, in the days to come I hope to conduct similar experiments with discarded batteries using Pulse Tech equipment to see if they can be resurrected. The test results will be shared at future meetings and in this newsletter. If any of you have had experience in reviving old batteries don't be shy in sharing your knowledge with us. In fact if any of you know anything about batteries come to our meetings and share your insights. Help us to better understand the mystery of a battery's power.

In future newsletters and in our meetings we hope to learn more battery basics. The more we understand how batteries work, and the chemistry behind them, the better off we will be as an informed organization and the better off to advise others. Sound advice for all electric car owners should be, "Know your battery and understand how it works!"

ALL SET FOR DURYEA DAY?



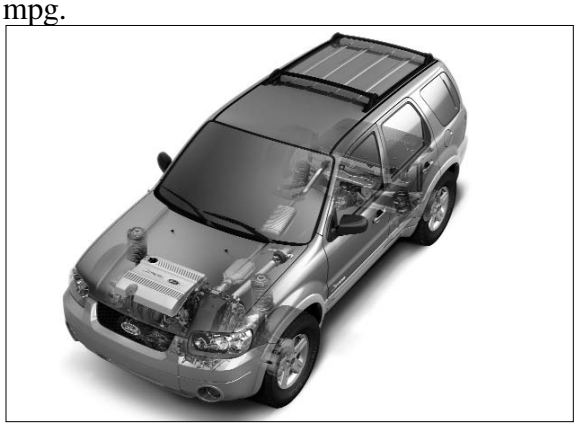
Duryea Day 2004 will be held in the Boyertown Community Park on Saturday, Sept 4, from 9:00 a.m. to 4:00 p.m. Will your car be ready to show? If you register before August 20 the fee is only $10; it's $12 if you register on the day of the show.

Duryea Day has been the EEVC end-of-summer event for many years, and even if you don't show a car it's lots of fun to attend, with antique cars of all types and all ages (with an occasional surprise included), car games (can your can win on the teeter-totter?) the famous Duryea Day flea market, plus lots of food and music. And don't forget that admission to the event as a spectator includes admission to the Boyertown Museum of Historic Vehicles at 3rd & Walnut St., with all its EVs and antique cars of every description (all having something to do with Eastern Pennsylvania). There's even a free trolley bus back and forth between the park and the museum.

The address for registration is Duryea Day, 85 Walnut St., Boyertown, PA 19512. For information, call 610-367-2090 or go to www.boyertownmuseum.org. That's also where you can get a registration form to print out and mail in.

FORD PRODUCING ITS HYBRID SUV

On August 5 Ford Motor Co. officially launched production of the 2005 hybrid Escape SUV at its Kansas City Assembly Plant. While its fuel economy figures—36 mpg city/31 mpg highway—pale next to the Prius and other hybrids, it is the first U.S. built one, and is the first hybrid SUV. and the first hybrid built in North America. The average for all 2004 model year SUVs was 17.9 mpg.



Ford plans to produce about 20,000 Escape Hybrids during in its first full year, which will be a tiny percentage of annual production. Note that Toyota plans to sell many more than that (see following story).

The vehicle has room for five adults and their gear. Its fuel-efficient, four-cylinder engine combines with an electric drive system to deliver acceleration performance similar to that of the V-6 Ford Escape. Ford says that the vehicle produces 97 percent less hydrocarbon and oxides of nitrogen emissions than vehicles that meet today's nationwide Tier I emissions standard, and qualifies it for the Advanced Technology Partial Zero Emissions Vehicle (AT-PZEV) standards.

NEWS UPDATE

Toyota ups hybrid production for '05

On the same day that Ford announced the start of production of its hybrid SUV, Toyota announced that it plans to increase hybrid car sales to 300,000 units worldwide in 2005, about seven times the 43,000 2003 worldwide Prius sales. Toyota said it will boost its monthly production capacity of the Prius to 15,000 vehicles in the first half of next year, up 50% from now.

Racing electric scooters in Holland

A recent Reuters story reports that a new sport has emerged in the Netherlands: electric scooter racing. The first Dutch championship

for battery-powered electric scooter racing was won by a team led by an 82-year-old pensioner, across a 250-yard obstacle course that included speed bumps, wooden ramps and plastic slalom cones.

Racing vehicles were rear-wheel-drive buggies with top speeds of 7.5 mph, while the drivers, recruited from 12 nursing homes, were in their 70s and 80s. Up to 75,000 people in the country own the vehicles.

Biomass moves ahead

DOE and USDA announced on July 16th the selection of 22 projects that will advance their joint Biomass Research and Development Initiative. DOE will award more than $12 million to nine projects, and the USDA will award more than $13 million to 13 projects, for a total of nearly $25.5 million in government awards. Nearly all of the DOE-funded projects relate to gasification technologies, although one project is aimed at producing new chemical products from biomass. The USDA-funded projects address a variety of technologies, including studies of feedstock supplies and treatment options; testing a new technology for ethanol production; using liquid fuels derived from biomass to power a fuel cell; developing a small-scale, biomass-fired gas turbine; and producing high-purity hydrogen from farm animal wastes. Including the cost sharing of the private-sector partners, the total value of the projects is nearly $38 million.

California utilities seek renewable energy

From DOE: Two of California's largest utilities—San Diego Gas and Electric Company (SDG&E) and Pacific Gas and Electric Company (PG&E)—recently announced their plans to add more renewable energy to their electricity supplies in order to meet the state's new requirements for renewable energy. SDG&E intends to meet California's requirement for 20 percent renewable energy seven years early: by 2010 instead of 2017. The utility seeks to buy power from any eligible new renewable energy facility (the state requirement allows a wide variety of technologies) or to acquire the new facilities, if they are located within its service area and draw on either wind power, solar photovoltaic power, or geothermal power.

SDG&E has also updated its long-term energy resource plan; the latest version shows that energy efficiency and renewable energy will meet all of the utility's growing energy needs through 2011.

PG&E issued a Request for Offers on July 15th, with the goal of entering into power purchase contracts by the end of the year. Unlike SDG&E, PG&E does not appear interested in acquiring renewable energy facilities. The utility seeks to procure about 1 percent of its retail sales volume, or about 711 million kilowatt-hours per year, from renewable energy sources.

Wind power for Wisconsin, Nevada

Also from DOE: Large wind power plants are under development in Wisconsin and Nevada. In Wisconsin, Invenergy Wind LLC is planning to build a 60-megawatt wind power plant near Brownsville, about 60 miles northwest of Milwaukee. Wisconsin Public Power Inc. (WPPI) and Madison Gas and Electric (MGE) have teamed up to buy all the power from the new facility for the first 20 years of operation. Called the Forward Energy Center, the new wind plant is expected to begin operating in August 2005.

In Nevada, Navitas Energy has submitted a proposal to the Bureau of Land Management (BLM) Winnemucca Field Office to build an 80-megawatt wind power plant in the Dry Hills, about 22 miles northeast of Winnemucca in the north-central part of the state. Called the Getchell Wind Farm, the facility will consist of 40 wind turbines, each two megawatts in capacity. Although the BLM is just starting the environmental review process for the proposed wind plant, Navitas intends to begin construction in late spring of 2005, with commercial operation starting six to nine months later.

Feds give tax breaks to SUVs

A story by Shawn Langlois on *CBS Marketwatch* reports that Federal tax breaks for hybrids are flat or declining, while the biggest SUVs get a substantial subsidy.

Buying a Prius or other hybrids gets you a one-time tax deduction of $1500, down from $2000 in 2003, and due to be phased out altogether by 2007, while small businesses can deduct up to $100,000 for the purchase of a

truck that weighs more than 6000 lb—which is a pretty good incentive to buy the biggest gas-guzzling SUV available.

Environmental and other groups are, understandably, outraged, but there is little prospect of a change in the SUV tax break any time soon. Efforts are under way to extend the tax break for hybrids for at least a while.

COMING EVENTS

Advancements in Battery Charging, Monitoring & Testing Technology Symposium
August 18-19, Denver, CO. For information go to www.batterypoweronline.com.

World Renewable Energy Conference VIII
Aug 28 to Sep 3, Denver, CO. Call Robert Noun, NREL, 303-275-3062.

Duryea Day 2004
Sept 4, Boyertown, PA. Call 610-367-2090 or go to www.boyertownmuseum.org.

Cruisin' Southern Cal: 2004 Fuel Cell Vehicle Road Rally
Sept. 17-19, Los Angeles to San Diego, CA. Contact The California Fuel Cell Partnership, 916-371 2870, or go to www.fuelcellpartnership.org.

AltWheels Alternative Transportation Festival
Sept. 17-19, Brookline, MA. Contact Alison Sander, 202-824-7362, or go to www.altwheels.org/ index.html.

22nd National NGV Conference and Exhibition
Sept. 19-22, San Antonio, TX. Contact Stephe Yborra, 202-824-7362, or go to www.ngvc.org/

Electric Drive Transportation Association Conference
Sept 21-23, Orlando, FL. Contact Pam Turner, EDTA Conference Manager, 408-741-5870, or go to www.edtaconference.com

Electric Transportation Industry Conference 2004
Sept 21-25, Kissimmee, FL. Call Kara Elsden, 202-408-0774

Hydrogen and Fuel Cells 2004 Conference and Trade Show
Sept. 25-28, Toronto. Contact Advance Group, 800-555-1099 x2, or go to www.ngvc.org/

ITSC 2004, 7th International IEEE Conference on Intelligent Transportation Systems
Oct 3-6, Washington, DC. Contact ITSC 2004, 732-562 3870, or go to www.itsc2004.org/registration.html.

Alternative & Advanced Energy Technologies: Manufacturing Challenges & Opportunities
October 12-13, Dearborn, MI. Contact Irene Spanos, SME Communications, 313-425-3155, communications@sme.org.

Michelin Challenge Bibendum 2004
Oct. 12-14, Shanghai, China. Contact Nathalie Zhang, 86-21-5835-6012, or go to www.challengebibendum-registration.com/Default.asp?language=EN

The 2004 Fuel Cell Seminar
Nov. 1-5, San Antonio, TX. Contact Courtesy Associates, Inc., 847-768-0816, or go to www.fuelcellseminar.com.

SAE seminar: Hybrid Vehicle Technologies—Today & Tomorrow
February 9-10, 2005, Costa Mesa, CA. Contact Nancy Eiben, 724-772-8525.

POWER-GEN Renewable Energy
March 1-3, 2005, Las Vegas, NV. Contact Donna Welch, 918-835-3161, http://pgre05.events.pennnet.com.

EVS-21: The 21st Worldwide Battery, Hybrid and Fuel Cell Electric Vehicle Symposium & Exhibition
April 2-6, 2005, Monte Carlo, Monaco. Contact the EVS-21 Monaco Organization, +377 97 77 54 21/+377 97 77 54 22.

MEETING SCHEDULE

The September meeting will be held at Plymouth-Whitemarsh High School, as before. If Room 35 is unavailable we will assemble in the parking lot and head down to Brittinghams.

September 8

October 13

November 10

December 8