

EEVC NEWSLETTER

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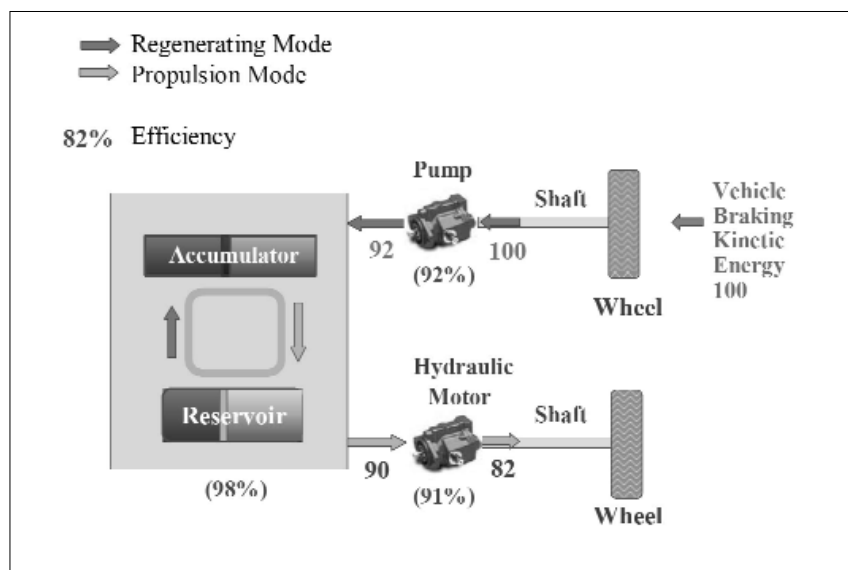


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EPA, FORD SHOW HYDRAULIC HYBRID

The first hybrid vehicle debuted in 1895; it used a gasoline engine with an electric motor to boost acceleration. Today's hybrids do exactly the same thing, with the addition of regenerative braking. The system allows the use of an internal combustion engine rated for the average, rather than peak power needs of the vehicle. But the auxiliary system need not be electric. Any system that allows energy to be stored and released rapidly would work, and the EPA has been working on such a system using hydraulics since 1991.

At the March SAE World Congress EPA showed a Ford F-550 commercial demonstration vehicle with a hybrid system that



The EPA hydraulic SUV claims a 55% fuel economy advantage.

reportedly gets 55% better fuel economy than a conventional Ford Expedition. What's more, EPA predicts that adding the hybrid technology would increase the cost of a large SUV by only about \$600 — which would be quickly recovered in

fuel and maintenance savings.

How it works

Instead of a large gasoline engine and conventional transmission there's a small diesel engine driving a hydraulic pump, while a hydraulic motor/pump takes power to and from the wheels. A hydraulic accumulator provides energy storage. A partial schematic of the system is shown in the figure.

TIMES ARE CHANGING, RAPIDLY **Oliver Perry**

Keeping in tune with the August article, "Batteries are Back?" I hope that you will find my following comments and observations encouraging.

Recently I happened to catch an interesting report via public radio on the realities of upcoming world shortages of oil. China was cited as a rapidly developing nation that would create demands beyond supply. I can't remember the exact statistics, but according to this particular report, China was cited as one of the major causes of our present gasoline price hikes because she is currently demanding more and more petroleum. With one of the fastest growing economies in the world, the demand for transportation energy in China is predicted to become enormous. Since we are told that our nation's economy is directly related to the price of a barrel of oil, China and the rest of the growing world are affecting our pocketbooks as they create a world oil shortage by their demands to match our standard of living.

A few days after I listened to the NPR report I was equally "floored" by a world population distribution report. If the chart was correct, Europe has a larger percentage of population than North and South America together! And more than 50% of the world's population lives in Asia! We may think we are the most important people in the world but we sure are outnumbered!

When you see the population figures you can understand why many of our U.S. business people are anxious to invest in China. On a recent TV business interview with Pepsi's CEO, it was made very clear that both Coke and Pepsi are working very hard to establish markets for their products in China. They are trying to awaken people who are accustomed to drinking warm non-carbonated drinks, to the wonders of ice cold carbonated ones. (We want to hook them on drinks loaded with sugar, suitable to ruin the health and well being.) Another point of interest: New Jersey was presented as the least profitable state for Pepsi. Pepsi makes the least amount of money per can of soda sold because of high salaries and the associated health benefits of their NJ employees.

Labor costs and associated employee benefits are causing many companies to go abroad for higher profits. Many Americans are becoming increasingly upset with the loss of computer programming jobs to Pakistan, manufacturing jobs to Mexico and the textile business to Asian countries. Two separate individuals, sitting at our table at a wedding that we attended recently, each suffered job setbacks because of cheaper labor in Asia. When I asked them for the solution to this rapidly increasing economic problem, there was no positive answer. Cheaper labor outside our country was the direct reason that both had been economically punished. The suggestion of changing presidents to cure their financial problems quickly passed as only a temporary fix at best. Depression quickly set in when we focused on the root causes of our economic woes.

Catch 22

The basic causes of our economic problems seems to lie in the hands of billions of people elsewhere in the world, most of whom want to match our standard of living. How long can we maintain the highest standard of living in the world, consuming most of the world's resources, without repercussions? As long as billions of people elsewhere in the world are willing to work for much less than the American worker, our manufacturing gurus will take advantage of the cheapest services regardless of who is or is not our president. And as one of the members at our table stated, "Now that foreigners have taken away my job I have to go to Wal-Mart to buy their less expensive products because I can't afford to pay for items manufactured at my former wages!" So we ourselves empower the system to continue to outsource!

Is an isolationist economic policy a practical solution?

Just as we cannot go back to pre-nuclear arms days, it does not seem to me that we can go back to isolationist political practices. We cannot un-invent modern technology. Mayberry USA is a wonderful place to revisit and relive in the black and white Andy Griffith TV reruns. But, can we ever return to that period of history? We can never go back and relive our youth in real time. (Although we

did see a 90 year old man doing a rock and roll dance with more energy than a teenager at a wedding we recently attended. He was inspiring.) Again it seems to me that whether we want to or not, we cannot as a nation successfully return to a contained economy. We must learn to live in a *global economy*.

The Global economy is here to stay. Jobs have permanently changed. Traditional typewriters are never going to return. Our basic technological lives have been forever changed. We must adjust with the change or die. And some of us simply don't have the energy left to keep up with the many rapid changes forced into our lives. "Darn, where are the simple dial TV and radio controls?" If we forget the coding of one command button on our microwave we can't even warm up our cup of coffee. Unless we want to be totally dependent upon others we must keep learning how to use and utilize the new technology. And let's face it, in time most of us reach a point where we become tired of learning.

The older we get the more we yearn for the good old days. It is fun to revisit the past. There is a place for the Boyertown Museum and always will be, but even the Amish have been forced to slowly modernize. It is a law of nature that we can't stop progressing. The American Indians tried to keep their way of life simple but the discovery of Columbus initiated its end.

Horses get run over when they slow their pace. Change is inevitable.

There will be a redistribution of wealth

History teaches that the wealthy cannot live in peace next to the poor for extended periods of time. Wealth will be redistributed by one of the "Four Horsemen." Our political leaders must consider our world neighbors in an economic global society if we are to retain our standard of living. Isolationism is a thing of the past. What happens anywhere in the world affects us in some way. From global warming to the price of a gallon of gas, from an AIDS virus to a mosquito, a penguin to a polar bear, and a hole in the ozone layer to thaw in the frozen tundra, we are all affected, interrelated and connected. The oceans that once separated us from others on this planet have become very small indeed.

What is the answer?

In an old Bob Newhart TV show, Bob the psychologist becomes very depressed over his failure to offer a permanent cure for his patients. In an attempt to find a solution he revisits his old psychology professor. Pointing to the many books behind his desk, Bob's professor asks Bob if he wants to know what he the professor has found to be the answer to all of the problems of life. The answer, given in this tremendously popular comedy show, turned out to be GOLF!

So, keeping with the Newhart theme, let me propose to us that the answer to our nation's economic problems is the BATTERY. It may sound funny but maybe there is some substance to that answer.

Perhaps the scoffers who mockingly thundered by us on the highway and told us to get a "real car" or asked us where our plug was, will be laughed at instead of us! Maybe the Kriebicks, who reluctantly were forced to relinquish their electric car sales in Philadelphia for lack of public interest will be vindicated at last. I still remember Ed's wife lamenting that nobody would ever become interested in buying an electric car.

What we have predicted has come to pass. Gasoline prices have risen and interest in electric and hybrid cars has returned.

My wife and I recently visited her college roommate in Connecticut. The roommate's sister, now a retired army doctor living in Oregon, has recently purchased a Honda Hybrid car. She brought with her an Oregon newspaper that had a feature article on the new hybrid cars. I found reading it to be like reading one of our newsletter articles, complete and accurate.

While visiting Mom in New York State, one my sister's old friends, an active nurse now living in California, checked in for a visit. After she complained about the cost of gasoline in California, I asked her if she knew anyone in California that drove a hybrid.

She did.

All of us know people that have recently purchased a hybrid car. Hybrids are making the scene everywhere. Hybrid articles have become ubiquitous in news journals and newsprint. They are almost no longer newsworthy pieces. If the report I heard on

National Public Radio (NPR) is true, that China has a growing demand for fuel (to supply the equally growing demand for scooters and cars) that our world suppliers of petroleum cannot meet, our raised gasoline prices might be here to stay. These higher prices will advance both the electric and hybrid car movement.

Crude oil prices have topped \$52/bbl in recent days, and indications are that while they may come down a bit, we will not see \$25 oil again. The current future price for December 2010 crude is about \$36/bbl.

Another personal story of related interest, which I happened to again pick up on NPR, was an account from a commuter that daily travels from Eastern Pennsylvania to New York City. The cost of living in New York City and North Jersey has spawned a building boom for homes in Pennsylvania. Many towns and new developments in Eastern PA have large numbers of commuters driving from one to two hours each to and from their jobs. The middle income family provider, interviewed by the NPR reporter, related that he gets up at 3:30 a.m. daily to begin his long commute. The first thing he and many others must do, after they stumble into their cars under a cloak of darkness, is to stop at the local gas station. The cost of commuting is killing them. Although the individual interviewed on NPR drove an economy vehicle, he reported that he was still spending more than he could afford on fuel. The implication of the report was that our new (or present) president should do something to lower the cost of the commute.

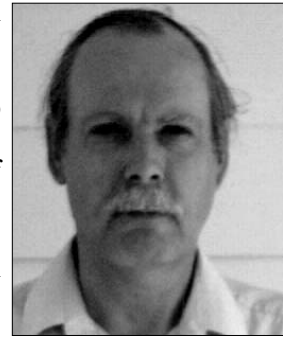
My impression of this story, however, is that we have an even greater need than ever for more efficient commuter cars. China, by demanding larger supplies of petroleum, may also be forcing us to implement more batteries in transportation and to leave more SUVs in our driveways. And that, my fellow EV enthusiast, may be a good thing.

The solution to part of our economic woes could be increased usage of the battery in transportation applications. Let's keep shooting for better and improved batteries as the rest of the world continues to pick our pockets. Guy Davis and people like him may become heroes to those of us who might feel that we are being fleeced at the gas pumps.

We will continue to explore battery technology in future meetings and in this newsletter in order for us to gain a better understanding of it.

WANT SOME ART WITH THAT? By California Pete

This month's column on the wonders of California is about a fountain. It has nothing to do with EVs, but it's sort of emblematic of the place.



Designed in 1971 by French Canadian artist Armand Vaillancourt, the 40 foot high, 710-ton sculpture sits in Justin Herman Plaza by the Embarcadero, an attractive area of broad plazas and fine views of San Francisco Bay very popular with tourists.

It's perhaps the ugliest piece of public art ever built outside the Soviet Union. Vaillancourt was laughed out of town after it was completed. The late *San Francisco Chronicle* columnist Herb Caen said it looked like a pile of poop.



When the fountain was built it stood in front of the Embarcadero Freeway, an ugly and unpopular two-level highway that cut off much of the view of San Francisco Bay from the waterfront area. The 1989 Loma Prieta Earthquake so damaged the freeway that it was torn down in 1991, greatly improving the view from the waterfront but leaving the Vaillancourt fountain looking out of place. On top of that, about three years ago it was

shut off due to the energy shortage, and was used as a bunkhouse by the homeless.

Supervisor Aaron Peskin in March proposed removing the fountain, although there is reason to believe that the proposal was a ploy to get someone to put up the money to get the thing going again, and not simply because it is so ugly. The proposal was defeated, and the fountain was restarted on August 2 of this year. It seems safe for now, but I still can't understand why this famously seismic city would want to keep something that looks like the aftermath of a severe earthquake or a nuclear attack. Only in San Francisco, I guess...

ZAP INCREASES SMART CAR SELECTION

Smart cars, designed by Swatch and built by DaimlerChrysler, swarm over European roads like so many insects. Only a bit more than 8 feet long, they fit in parking places that no vehicle other than a motorcycle could use, and offer fuel mileage up to 60 mpg. But they have been absent from U.S. roads, partly because they don't, without alteration, meet federal guidelines, and partly because the manufacturer feels they would not be accepted by American buyers.

One model of the Smart car is available in North America with the manufacturer's blessing—just not in the U.S. Imports to Canada of the new fortwo coupe and cabriolet models began in October with base manufacturer's suggested retail prices of \$16,500 Canadian (\$13,197 U.S.) and \$19,500 Canadian (\$15,596 U.S.). The company says that it chose Canada for the North American introduction because it considers Canada to be the most European country on the continent.

The engine is a 40 hp three-cylinder turbodiesel; top speed is 135 kph (84 mph—perhaps downhill with a tailwind) and rated fuel consumption is 4.8 liters/100km (49 mpg) in town and 3.4 liters/100 km (69 mpg) on the highway.

DaimlerChrysler does plan to sell a version of the Smart in the U.S. eventually: An SUV version called the formore is scheduled for sale in the U.S in 2006, and the forfour sedan model may be next after that.

If you don't want to wait that long, ZAP (Santa Rosa, CA) has begun importing them and getting them certified for use on U.S. roads. ZAP's cars are two-seaters with 60 hp three-cylinder gasoline engines that deliver 60 mpg. With an 8.7-gallon fuel tank, that should give a 522-mile range, although most people probably wouldn't want to try that in one sitting. The ZAP Web gives neither the date for deliveries to start nor the price, although a *CNN/Money* story by Peter Valdes-Dapena dated September 4 suggests it will be "from the teens to as much as \$23,000."

ZAP also sells a line of low-speed NEVs (neighborhood electric vehicles) and keeps a selection of uses EVs of various types in stock.

Several companies have built electric versions of the Smart. The UK firm Zytek Automotive Ltd. showed a prototype at EVS-20 in 2003, and *Automotive Industries* reported in January that Wavecrest has developed a roadster version, using its own Adaptive Motor technology, which was reviewed by *EV World* in July. Emotion Mobility, LLC announced in 2001 that it was working on an electric Smart using technology from Solectria, but the company ceased operations in the first quarter of 2004.

Fuel cell Smarts

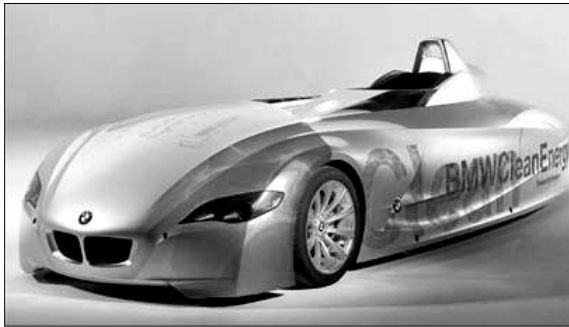
While nobody may be actively converting Smart cars at the moment, research continues. ZAP has been working on a fuel-cell car, and has been using a Smart as the test bed. The company announced in August that it was working to develop a drive system using a hydrogen fuel cell and a lead-cobalt battery design developed by Apollo Energy Systems.

Apollo claims a higher voltage, higher efficiency, and greater reliability for its alkaline fuel cell than other types of fuel cells. The Apollo tri-polar lead-cobalt battery uses lead-foam electrodes for lighter weight in increased energy and power density. It claims the new battery would replace nickel-metal-hydride and lithium-ion in many applications for approximately 20 percent of the cost.

The developers of the system, Apollo CEO Robert R. Aronsson and Apollo Director Dr. Karl Kordesch, envision a coast-to-coast "Hydrogen Expressway" with liquid ammo-

nia (NH₃) stored in large tanks at gas stations along the way. Cars would use an on-board ammonia cracker to convert the ammonia to hydrogen for the fuel cells.

HYDROGEN CAR SETS RECORD—SORT OF



BMW recently unveiled a hydrogen-powered car with a claimed top speed of 185 mph and acceleration from 0 to 60 mph in about 6 seconds. The H2R, however, is not a fuel cell car; it uses a 6-liter, 12-cylinder engine running on compressed hydrogen.

NEWS UPDATE

CA imposes new emission rules

On September 24 the California Air Resources Board approved new rules to reduce auto emissions that contribute to global warming. The new regulations require automakers to reduce exhaust by 22% by 2009 and by 30% by 2016. The auto industry threatened to sue, claiming that compliance would add \$3000 to the cost of a car, while CARB estimates the added cost at a bit more than \$1000, which, it says, would quickly be made up by savings in fuel costs. Gov. Arnold Schwarzenegger has pledged to fight any such lawsuits.

It is likely that California regulations could be adopted by other states, which adds to the car companies' worries.

New hydrogen storage method

An article by Alton Parrish in *Fuel Cell Technology News* for September 4 reports that Kvaerner Technology Research Ltd. has developed a carbon-based hydrogen storage system that could hold enough hydrogen to give a fuel-cell car a range of 1000 km (625

miles). The system, according to the article, uses a form of carbon called carbon cones with a microstructure that provides much greater surface area—and hence hydrogen storage capacity—than any yet developed. Pilot production of the new material is planned for 2005.

Whistler opens on-line EV store



Whistler Investments, Inc. (www.whistlerinvestments.com) and its subsidiaries R- Electric Car Co., Global Electric Corp., and Solium Power Corp. have announced the opening of an on-line

store that will sell the E-Cobra electric motorcycle. The E-Cobra claims range to 120 miles and top speed of up to 60 mph using a 2 kW motor and lithium batteries. The selling price is \$5995. The company has other electric bikes which it sells through dealers, and another Whistler subsidiary, R-Electric Car, is working on a variety of EVs which it showed at the 2004 World Energy Engineering Congress in September in Austin, TX.

Fuel cell market estimated

ABI Research (Oyster Bay, NY) has revised downward its forecasts for the growth in numbers of vehicles powered by hydrogen fuel cells. The main stumbling block is the lack of a viable network of hydrogen refueling stations, which will require clearer government commitments at both national and local levels that would get the energy companies involved.

Japan did set an unrealistic goal of 50,000 fuel cell vehicles by 2010. But it's not enough. If a major government operating a large vehicle fleet committed to a 10% conversion to fuel cells and laid out a roadmap for getting there, that would send a powerful message.

In a move Ozbek sees as very positive, China intends to have a large fleet of fuel-cell vehicles ready in time for the 2008 Olympics. But despite oil's obvious shortcomings, most governments still hesitate to spend enough money to kick-start this untested new industry.

The new regional forecasts are contained in the ABI Research report, "Fuel Cells for Vehicles," which updates the analysis of the sector by end-use market applications: passenger vehicles, buses, trucks, and niche vehicles.

Hydrogen Economy Initiative good news for Ballard

Ballard Power Systems reports that nearly half of the Department of Energy's announced fleets under the Hydrogen Economy Initiative will be Ford and DaimlerChrysler vehicles, and all of these will be powered with Ballard fuel cells.

A reprieve for Think cars

On September 16 AP reported that Ford Motor Co. has agreed to return about 300 of its Norwegian-built Think EVs to Norway. Ford had announced plans to scrap the cars, but was met by protests from the Norwegian government, Greenpeace and others because at least 200 Norwegians are on waiting lists to buy Think cars. Ford says it will examine the cars (which had been leased for several years in the U.S.) and sell those that are deemed to be in good enough condition through its own dealers in Norway.

GE to supply wind turbines to Canada

GE Energy has been selected to supply up to 660 wind turbines, totaling 990 MW of wind-generated electricity, for eight projects in Quebec to be placed on line between years 2006 and 2012. This is the largest single award for new wind generation capacity in the history of the global wind energy industry.

Canada's installed wind energy capacity currently totals 372 MW, including 113.25 megawatts in Quebec. Forecasts by the Canadian Wind Energy Association (CANWEA) anticipate the installation of 10,000 MW of wind power across the country by 2010.

Peugeot shines at Paris Auto Show

A standout at the Paris Auto show in September was French carmaker Peugeot Citroen, which showed several models designed to reduce fuel consumption. First was a device, installed on a Citroen C3, that automatically stops the engine when the vehi-

cle is waiting at a red light or is stuck in traffic; the company claims a reduction in fuel consumption and CO₂ emissions of up to 15 percent, although in typical city driving that drops to 10%. The device adds 550 euros to the price of the car.

The company also showed a natural gas-powered C3 with a range of 250 to 300 km (156 to 187 miles) set for launch in 2005. Refilling is done with a pump installed at the owner's home.

Electrics were hard to find at the show, according to the *Bahrain Times*; Renault says it may develop one someday, but CEO Louis Schweitzer said that an EV is better suited for postal delivery or other local services than for the average consumer. and little has been heard of the EVs Peugeot was working on back in the 80s.

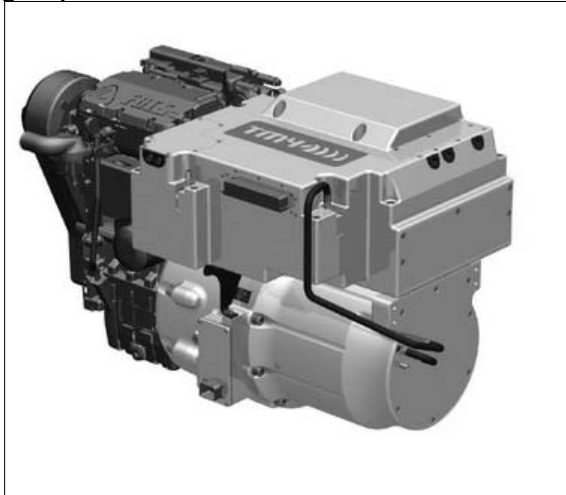
MacCready sounds off on hybrids, BEVs

On October 4 *Green Car Journal* ran an interview with Dr. Paul MacCready, inventor of (among many things) human- and solar-powered airplanes and the Sunraycer. Dr. MacCready came to the conclusion that the answer for cars is an increase in efficiency. He doesn't especially favor fuel cells, for that reason. MacCready: "For a car, using hydrogen to generate electrical energy for powering the vehicle is about one third as efficient as using a battery. Also, a fuel cell does not work in the reverse direction except in very expensive units, and so cannot serve to store energy from braking or give utility energy back for adjusting utility levels. Every house, along with electricity, becomes an energy source for the battery-powered car."

Part-time hybrid



Also on display in Paris was something we haven't seen outside the Tour de Sol and a project that Guy Davis built many years ago: a part-time hybrid. The vehicle, called the Cleanova II hybrid, was presented by the Societe de Vehicules Electriques (S.V.E.), a company formed by the Dassault and Heuliez groups.



Based on a Renault Kangoo platform, the car uses a drivetrain developed by TM4 (Boucherville Québec) that integrates in a single module a 35 kW electrical motor and a 15 kW ICE-powered range extender generator with an integrated differential. The same module also houses all the associated control and power electronics, the DC-DC converter and the battery charger. The system allows the vehicle to operate as a straight EV, as an EV with range extender, or as a higher-performance EV.

S.V.E. intends to commercialize the vehicle in the second half of 2006. A full electric version, also equipped with a TM4 drivetrain, will be commercialized concurrently.

Peugeot Citroen did show a two-seater fuel cell prototype called the Quark that looks, according to the Bahrain Times, more like "a quad motorcycle than a car." The Quark weighs 425 kg (935 pounds) and can reach speeds of up to 110 kph (68 mph), with a range of 100 km (62 miles). The vehicle, according to *Motor Trend*, has an aluminum and carbon fiber body and frame and an electric motor driving each 17-inch wheel. The electric drivetrain was supplied by TR4.

COMING EVENTS

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.

H2PS: The 2004 Hydrogen Production and Storage Forum

December 6-8, Washington, DC. Contact Brian Santos, 207-781-9800, bsantos@intertechusa.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

Meetings are held in Room 215, Plymouth-Whitemarsh High School, 201 East Germantown Pike in Plymouth Meeting, PA, and begin at 7:00 p.m.

November 10

December 8

January 12

February 9