E E V C
INDEPENDENT MOTORING

EEVC NEWSLETTER

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TWO PENNCREST HIGH SCHOOL STUDENTS WINNERS OF THE EEVC RON GROENING BEST ELECTRIC CAR AWARD FOR EXCELLENCE IN ENGINEERING IN THE 2013 PHYSICS OLYMPICS

Each year the EEVC attends the last meet of the Southeastern Pennsylvania Physics League and selects a student (or student team) to receive an annual award in memory of former EEVC member Ron Groening, an engineer who worked for GE, whose division was later purchased by Lockheed Martin. Our focus is on the annual model electric car competition, an event that we have helped promote for more than twenty years.

Winners of the EEVC Ron Groening Best Electric Car Award: For Excellence in Engineering in the 2013 Physics Olympics. Pictured holding their winning car are Maddie Conway (left) and Meilin Else (center) from Penncrest High School. Standing next to them on the right is their physics teacher, Mr. James Ciccarelli.

This year's winners of that award were two lovely girls from Penncrest High School, Maddie Conway and Meilin Else. Both are juniors currently enrolled in an honors first year physics class taught by Mr. James Ciccarelli. "Cicc," as he is called, is a great teacher and heavily involved in Physics Olympics. He is currently the Penncrest High School Physics Olympics team coach.

The 2013 Electric Energy Efficient Car Physics instructor and Physics Olympics Interboro Coach, Marian Venturini, created and supervised this year's event entitled The 2013 Electric Energy Efficient Car.

The scoring for this event was unique. Not only was speed important, but so was the voltage needed to obtain the speed. The lower the voltage the higher the score.

Score = 100/voltage x time

The cars raced the length of a track outlined on the gym floor 1.5 meters wide and 10.0 meters long.

In the past we found students loading up their cars with as many battery packs as possible in order to produce the maximum voltage that their motors could take to get high speeds. This year, because of the unique scoring system, the students concentrated on keeping their voltages as low as possible while still getting a reasonable speed.

Maddie and Meilin's Design

Multiple drawings and drafts were made initially in search for a light strong vehicle that would be unique and fast. The result was a three-wheeled vehicle (two in front) made with mini CDs that used rubber cut from a balloon and stretched over the edges for traction. A three-wheel design with steering from a single wheel would be easy to adjust to ensure a straight run for the required 10 meters.

The challenge for most student built cars in the past has been to get the cars to track in a straight line. The single wheel placed in the rear, connected to the main frame with a single wire to reduce body weight, turned out to be easy to adjust for straight line travel. The single wire was relatively easy to bend in order to vary the back wheel's tracking.

In the construction of any vehicle, model or life size, the method of connecting the power source to the drive wheels is always a major consideration. Matching the power source to drive wheels can be done many ways. Since the front wheels (which were both connected to the same solid axle) didn't have to be used in steering, the electric motor could be linked to the front axle by means of two gears, one on the motor and one on the axle.

In the words of Meilin Else, "The gears we bought came with an axle that fit the gear size, so finding an axle and fitting it to the gears wasn't a problem. One of the gears also happened to fit the motor, which made it very easy to connect them, and then that to the axle. From the very beginning, we decided on using gears and really didn't even consider belts because we needed the gear reducer to get the most power. We experimented with the gear reducer by changing the number of gears we used and eventually settled on the one that made the car accelerate quickly but still have a fast top speed."

For the electric energy source the girls decided to use the lowest voltage possible, 1.5 volts, and either a C or double A battery. To save on weight they ended up with the AA. The car had no exterior body, just the essential frame and a platform to hold the necessary wiring, switch, motor, and gear components together.

A week and a half before the competition the girls tested their car on a track with photogate switches set up for timing. The car traveled the 10 meters in about 4.8 seconds. On one of the trials the car crashed into the photogate and broke a front wheel. After rebuilding and more testing the girls reported that they shaved off about 0.8 seconds on the time.

We inspected the car and were impressed with the neatness and ruggedness of the construction. The car was made out of strong materials, mostly metal, which were relatively heavy. As a result, the car's performance was consistent throughout all of its five competitive runs. With the exception of the last trial all went very well. For some reason the car swerved off the track just short of the finish line. Since only the best of the five runs counted in the scoring, the last bad run didn't affect their results. The girls earned second place and the silver medal.

About the girls themselves

It is always interesting to find out why some students succeed and others come up short. Over the years I have observed that in many cases the students who win our EEVC award come from successful families.

Meilin's family includes her mom, dad, and younger sister. Both of her parents are engineers and lawyers. Her mom is an environmental attorney at the EPA and her dad is an advertising and marketing consultant.

Maddie has two parents and an older brother who is a junior in college. Both of her parents are IT professionals. Her father is a Microsoft certified professional specializing in Cloud computing at QVC. Her mother is an IT manager in the field of identity management.

In addition to being on the Penncrest High

School Physics Olympic team, Meilin runs cross-country in the fall and participates in spring track. She is a part of the Hi-Q team during the winter season. She belongs to the National Honor Society, Math Honor Society, History Honor Society, English Honor Society, and World Language Honor Society. She also belongs to the high school orchestra and the Delaware County Youth Orchestra.

Maddie, in addition to participating in Physics Olympics is also a runner. She runs cross-country in the summer and fall, track in the winter and spring. Maddie is a member of National Honor Society, World Language Honor Society, Math Honor Society, Language Arts Honor Society, History Honor Society, and Art Honor Society. Her creative art projects fill any gaps of time that might exist between her academic work and running.

Next year Maddie will be a senior at Penncrest High. She has several colleges in mind to apply to: Philadelphia University, and the University of Central Florida. She hopes to major in animation and digital media because of her love for both art and technology.

Meilin, on the other hand, has not thought quite that far ahead. She plans on taking AP Physics next year in her senior year at Penncrest High School and hopes to major later in engineering in college.

The Physics Olympics Experience

Those of us who have devoted years of our time to the Physics Olympics League have done so in order to make physics fun for our students and to attract more students into our programs. We see the need for students to appreciate applied physics. We were interested in what Maddie and Meilin thought about their Physics Olympics experience.

Meilin: "My experience at Physics Olympics has made me understand the value behind working to achieve something individually, but (at the same time) for the group's benefit. Essentially our entire physics program (Penncrest High School with an outstanding winning record.) works together to try to win, and it is that common goal that makes us so successful as a school. In addition to being a learning experience for each and every one of us, physics Olympics has made it easier to create new designs for the projects we all have to do. At the meets, it is extremely easy to have a good time because even with the stress of competing against other schools, everyone is just there to have a good time."

Maddie: "My experience with Physics Olympics has been rewarding. Constructing projects such as the electric car has given me hands-on experience with the engineering field and a better foundation for physics class as well. For me as an artist, the creative aspects of coming up with an original design for a project that has been constructed so many times over is both challenging and enjoyable. While competing with students from other schools and also working with my own team, I have seen many innovative ideas in the variety of projects that were assigned this year. Physics Olympics pushes students to be creative and reach for their potential for the benefit of the team. "

Tribute to Robert Malkovsky

Robert Malkovsky is pictured on the right standing next to his student Tom Wills, who won the EEVC award in 2008. Robert Malkvosky passed away several weeks before the last Physics Olympics meet of the 2013 season.

Several weeks before the final Physics Olympics meet of the year, Penncrest High School teacher Robert Malkovsky suddenly died. Malkovsky had taken time off from teaching the previous year to fight pancreatic cancer. I spoke with him last summer; he was determined to beat the cancer, which I am told only 2% of those diagnosed with, recover from. Robert's fellow teachers witnessed his intense determination to get back into the classroom. And, in October of 2012 "Mal," as Malkovsky was affectionally called, came

back to his classroom, having remarkably beaten the cancer. His sudden death appeared to have been caused by heart failure as he sat in his chair at home listening to music on his computer.

"Mal" was totally devoted to the Physics Olympic program and spend many years as president of the Southeastern Pennsylvania Physics League. A tribute was given to him in the Harriton High School gym, at the last Olympic meet of the year, Feb 23rd, 2013. Link to tribute: Tribute to Mal-Feb 23,2013, http://vimeo.com/60975279

Maddie and Meilin's Tribute to "Mal"

Meilin: "Mr. Malkovsky continues to be an inspiration to everyone who knew him, from his beloved students to those not lucky enough to have had him. He always brightened everyone's day in whatever way he could, sitting in the main rotunda in the morning to tell everyone to have a great morning. I only got to talk to him a few times, but even then it was so apparent what a genuinely kind person he was. Mal was a huge part of Penncrest's physics department and really gave everything he could to be with his students because he loved teaching more than anything else. His students loved him and even people who didn't even take physics were really close to him. Mal will continue to inspire everyone at Penncrest to do the random acts of kindness that he was known for, and we are all better people for having known him."

Maddie: "Unfortunately, I did not have the opportunity to have Mr. Malkovsky as a teacher, to be close to him. Mal will continue to inspire everyone at Penncrest to do the random acts of kindness that he was known for, and we are all better people for having known him. However, his impact was not only on the physics department but also the Penncrest community as well. Mal has touched my life, just as he did so many others around me. His kindness was reflected in everything he did, even the little things such as greeting students, with a warm smile each the morning as they walked into school. It's amazing what an effect those kind of small gestures have on the community, because this is how he is remembered by many Penncrest students. To have Mal as a teacher must have been such a privilege. I have heard from his students how encouraging and supportive he was. According to them he was always thinking of others. Penncrest is a better place for having Mr. Malkovsky in the students' and teachers' lives."

Ron Groening Best Electric Car Award: For Excellence in Engineering in the 2013 Physics Olympics went to Maddie Conway and Meilin Else from Penncrest High School.

Bruce Kubanoff (left), one of the EEVC members who has helped us judge cars in the past, and Dan Monroe, one of our EEVC judges who helped out at the recent Physics Olympics, made donations of twenty dollars to be used toward the cost of the Plaques.

EEVC member Al Arrison (in center) focuses on some of the entries eligible for the EEVC Best Car Award.

PHYSICS OLYMPICS OVERVIEW
Oliver Perry

Physics Olympics Gold Medal Winners for the fastest electric car in the competition. All are seniors from Harrition High School. (LIeft to right): Justin Keenan, Holden McGinnis, and Alex Rosenbaum.

The Southeastern Physics Olympic League consists of approximately 10 to 12 High School teams from the Philadelphia region. One team, Cinnaminson High School, is from New Jersey. This year only nine teams participated in the league. Three meets are held each year, one in October, one in December, and the final meet in February. Each meet consists of a variety of challenging design and engineering projects which are brought to the meet for challenging competitive events. In addition to the "build it, bring it" projects, each meet features team design and building projects, as well as lab type problems, that are practiced on at home but completed on site in assigned times and spaces. Throughout the morning of competition students also work on packets of traditional textbook problems, the solutions of which are turned in at the end of the meet. Points are assigned to each event and problem. Team placement in each competitive

Physics Olympics winners of the Silver Medal for the second fastest car, from Penncrest High School, Maddy Conway (senior) and Meilin Else (junior).

Physics Olympics Bronze Medal winner for the third fastest car, from West Chester East HIgh School, senior Erik Laping.

Winners of the Racing Team Trophy, Harriton High School. (Left to right) Alex Rosenbaum,Holden McGinnis, Justin Keenan,and Alex Harriott

The trophy (invisible at this point because it was left in a closet at another school) is passed on every year to the best racing team. The High School's team name is engraved on it and the trophy moves around the league as different teams win it. The trophy goes to the team who races the most different cars in the event with the best competitive times. This year Harriton High School entered two cars in the five heats while Penncrest High School, who had five different cars, chose to run only their best car in all five heats. My guess is that the Penncrest team felt that that their best car was the only one that had a chance to beat Harriton's top score so they chose to run it all five times. Even then their best time fell short of first place. For Olympic scoring, getting best time is worth more than trying to earn the team racing trophy.

event, from first to last place, determines how many points each team is awarded. Not all events have the same point value.

Team scores are totaled at the end of each meet. The top team from each meet walks away from the meet with the banner. All scores are carried over to the next meet and totaled at the end of the season to determine the final placement for the year. Team placement trophies are given for the top four teams at the end of the last meet.

Individual awards are also given throughout the year.The more challenging "built it, bring it" devices are worth more in terms of team points and also provide individuals with gold, silver, and bronze medals for first, second, and third place.

EEVC supports the annual model electric car competition in the Physics Olympics

The model electric car event is a "build it, bring it" event worth 200 points in the Olympic scoring. It is also an individual medal event as well as a non-scored team trophy event. It has become an annual event in the last February meet of the year.

For over twenty years the Eastern Electric Vehicle Club has been directly involved in helping the Physics Olympics League conduct a model electric car competition of some type. I happened to be a physics teacher who coached a team in the Physics Olympics League back in the early nineties and was a member of the EEVC. The EEVC back then had members who were very enthusiastic in helping to sponsor this event. We (the EEVC) began to award a special EEVC best car award to the student or students who in our opinion constructed the overall best vehicle. Our award has always been kept separated from the Physics Olympic scoring. In addition to presenting our award we also assist the physics teachers in preparing for and officiating the event.

This past year the event was conceived and supervised by the physics teacher and Olympic team coach from Interboro High School, Marian Venturini.

The individual Olympic Medal results for the model Electric Car 10 meter race, conducted February 23rd at Harriton High School.

MORE ON CLUBMEMBER OF THE YEAR

Dan Monroe (left) receiving the plaque honoring him for being selected as our 2012 EEVC Member of the Year. Oliver Perry (right) EEVC president is presenting him the actual plaque, Feb 13th, 2013 at the monthly meeting in room 49, the calculus room. Dan now joins several of the previous "Member of the Year" recipients who have been likewise pictured with the great mathematicians of the world. (photo by Hans Kernast).

CREDIT WHERE CREDIT IS DUE

The EEVC members have presented "Paula," the head custodian of the Plymouth Whitemarsh High School night shift, a valentine and a bouquet of roses last month for her cheerful and faithful services to our cause. Plymouth Whitemarsh High School provides the EEVC with a room for our monthly Wednesday evening meetings. Paula makes sure that room 49 is always open, that the entrance to the school is also open, and that our needs are adequately met. She is the most faithful electric vehicle driver in our group. For all the time we have known her she has driven the electric golf cart that she is pictured in, all over the widespread PW campus. Paula is a true EVer. We will miss her when she retires in a few months.

NEWS UPDATE

A quantum leap for solar efficiency?

As we all know, light is a form of electromagnetic radiation like radio waves — albeit with much shorter wavelengths than the radio waves we use for broadcasting or even radar. But what if we could receive light radiation much as we receive radio waves, using some sort of antenna, and then rectify the resulting exceedingly high frequency alternating current coming from the antenna?

Over the years there have been a number of proposals to capture solar energy using satellites and send the power to the surface via microwaves. At the surface would be arrays of receivers in the form of combined antennas and rectifiers — rectennas — that would produce DC when they are irradiated (illuminated, if you will) with microwave energy.

These schemes have not come to fruition for a number of reasons, including both cost and safety, but the principle is technically sound.

So what if one could build a rectenna for light? At least some of the internal dimensions would have to be exceedingly small, to match the wavelength of light, which is about 600 nanometers for the color yellow. But these days we routinely build things that measure in the nanometers — that's what nanotechnology is all about.

An announcement from Penn State suggests that it may be possible to apply the principles of microwave rectennas to light using nanotechnology. Researchers at Penn State Altoona are leading a collaborative research endeavor between Penn State; the University of Connecticut, Storrs; and Scitech Associates Holdings Inc., of State College, to study the physics of a device that could revolutionize green solar power technology.

On Nov. 1, the National Science Foundation awarded the two institutions a total of $650,000 in a three-year grant to perform "Electro-optical studies of nanoscale, geometrically-asymmetric tunnel junctions for collection and rectification of light from infrared through visible."

At present, solar power technologies only use the infrared portion of the solar spectrum. The device to be developed by the team, based on patents held by Scitech Associates and University of Connecticut Professor of Chemical Engineering Brian Willis, would harness the visible part of the solar spectrum as well, a feat that has never been accomplished, allowing solar power technology to make a great leap forward.

The objective of the research project is to develop a "rectenna" device consisting of a nanosized antenna and an ultra-fast tunnel diode that simultaneously collects and rectifies solar radiation from infrared to visible. The manufacturing approach uses a chemical process called selective atomic layer deposition, a process originally developed by Willis, which is capable of fabricating arrays of thousands of nanoscopic, geometrically asymmetric tunnel junctions in a reproducible manner. An integrated program of device fabrication, characterization and numerical modeling will provide insight into device design aimed at creating larger arrays, to harness more power, and smaller junction gaps, to reach the visible spectrum.

Until the advent of selective atomic layer deposition, it has not been possible to fabricate practical and reproducible rectenna arrays that can harness solar energy from the infrared through the visible. The issue has been one of size — and size matters greatly in this case. To convert visible light into electricity, one needs to create large arrays of rectennas whose metallic electrodes are only a few nanometers apart, a distance that is about 30,000 times smaller than the diameter of a human hair. The fabrication, characterization and modeling of the proposed rectenna arrays will lead to increased understanding of the physical processes underlying these devices with the promise of greatly increasing the efficiency of solar power conversion technology.

The solar power conversion device under development by this collaboration of two universities and an industry subcontractor has the potential to revolutionize green solar power technology by increasing efficiencies, reducing costs and providing new economic opportunities. The realization of high frequency rectification is also important for developing new technologies for IR sensing, imaging — including medical and chemical sensors —

and for the transmission and reception of information. A large, diverse group of graduate, undergraduate and high school students will acquire extensive research experience and training. The four faculty members and two industry subcontractors have proven experience working with underrepresented groups including, women, minorities, and international colleagues and students.

The year of the hybrid supercars

The makers of ultra-expensive cars seem to be jumping on the hybrid bandwagon at this year's Geneva Motor Show. Ferrari has announced the $1 million LaFerrari (above; photo: Press Association), a car with a 789-horsepower, 6.3-liter V-12 gasoline engine, one electric motor for the wheels and another for the accessories, and a lithium ion battery pack. The car does zero to 62 miles per hour in fewer than three seconds and 124 mph in under seven seconds. Top speed is 217 mph (350 kilometers per hour). A total of 499 will be built.

Out with their own hybrid supercar is McLaren, whose P1 can do 0-180 mph (0-300 kph) in under 17 seconds. It sells for $1.3 million, and 375 are being built.

These two cars join the Porsche 918 Spyder hybrid (above), unveiled in 2011, which has a V8 engine with capacity of more than 4.0 liters and producing at least 500 horsepower, two electric motors with a total of at least 218 horsepower. Plans were to build 918 of them, with price of $845,000 in 2011.

Interestingly, the publicity materials for these cars talk about fuel economy. If you can buy one you probably don't have to worry about what you're spending on gas.

World's most efficient car?

Also at the Geneva motor show VW showed its new XL1 hybrid (above), which does not go 200 mph but has a European combined fuel consumption rating of 261 mpg. It's a diesel plug-in hybrid with 30-mile electric range and, with a weight of just 1753 lb and a drag coefficient of 0.189, requires just 8.3 hp to cruise on a level road at 62 mph and uses less than 0.1 kWh to go a kilometer.

Power comes from a 47-hp two-cylinder diesel, a 27-hp electric motor, a seven-speed automatic transmission and a lithium-ion battery.

LIGHTING UP THE BAY BRIDGE
By California Pete

The Bay Area just got a shot of favorable publicity, with 25,000 computer-controlled white LEDs attached to the riser cables of the suspension part of the Bay Bridge. The lights were turned on the other day and observers called them a hit, with never-repeating abstract patterns flickering across. The fact that Philadelphia's Ben Franklin bridge has had dancing lights since the Bicentennial does not seem to have occurred to the folks here. And how long it will remain popular remains to be seen.

The lights are on the old suspension section of the bridge, but the new section, which replaces the seismically unsound eastern span, will be dedicated on Sept 3, preceded by a $5.2 million party in which people will be allowed to walk across the span for free. The bridge was delayed for decades by political infighting and the vanity of two local politicians (both named Brown), who wanted it to be uber-inspiring to look at. I'm not sure how inspired I am to see it, considering it cost $6.4 billion, when the original cost estimate was $350 million, and it was built in China.

Quelle horreur!

Chez Panisse, the Berkeley restaurant that defined California cuisine (fresh, local and organic) 42 years ago, suffered a fire that damaged the front porch of the building but was, fortunately, prevented by a sprinkler from destroying the rest of the place; owner and founder Alice Waters hoped to reopen in a week or so. While not as bad as the time in 1995 that Le Bec-Fin's Georges Perrier almost lost four fingers of his right hand in a food processor accident, it was pretty traumatic for the local foodies.

We're number five!

I've been fond of talking about the problems in our neighboring city of Oakland, with high crime rates, poverty and dysfunctional government (the woefully-understaffed police department just barely avoided a state takeover, and California Highway Patrol officers are helping patrol the streets), but it turns out there's a city in even worse shape. Camden, NJ has just been declared the nation's poorest city. among its other problems. It's a truism that dying cities have corrupt governments (Detroit's ex-Mayor Kwame Kilpatrick was just convicted of a slew of corruption charges in federal court) and Camden is no exception, with an ongoing police corruption scandal the latest example. But Camden now has another distinction: the highest per-capita crime rate in the country. Oakland is fifth. Just saying.

Musk vows to pay off U.S. loan early

Tesla CEO Elon Musk, according to a February 27 AP story by Matthew Daly, has announced that the EV maker will pay back half of its $465 million DoE loan in five years, rather than the original ten, and said that, given ""the firestorm of criticism aimed at the Energy Department after the bankruptcy of solar company Solyndra, which received a $528 million federal loan, Musk said it was only fair that the administration wins praise for success stories such as Tesla. He said the company is on course to earn a small profit this quarter."

Sailing into the sunset

On March 4 a guy invited two strangers to party with him on an 82-foot luxury yacht tied up in the Bayside community of Sausalito, claiming that the vessel was his. Some time in the middle of the night he took the vessel out of its berth and ran it out through the Golden Gate where it went aground 20 miles south off the town of Pacifica. When police arrived all aboard were still busy with pizza and beer.

COMING EVENTS

CalHEAT Third Annual Forum
March 26, Sacramento, CA Go to http://calstart.org/Events/CALSTART-Events.aspx.

China International New Energy Vehicles Forum 2013
March 27-29, Shanghai. www.ourpolaris.com/nev2013/s-why.asp

IEEE Fifth Annual Green Technologies Conference
April 4-5, Denver. Go to http://sites.ieee.org/greentech2013/confer-

ence-program

SAE 2013 World Congress & Exhibition
April 16-18, Detroit. Go to www.sae.org/congress/

Electric Vehicles Land, Sea & Air Europe 2013
April 17-18, Berlin. Go to www.idtechex.com/electric-vehicles-europe/ev.asp

ICHEV 2013 : International Conference on Hybrid and Electric Vehicles
April 29-30, Johannesburg, South Africa. Go to www.waset.org/conferences/2013/johannesburg/ichev/

Next GenerationBatteries
April 30-May 1, Boston. Go to www.knowledgefoundation.com/viewevents.php?event_id=289&act=evt

Green California Summit & Exposition
April 18-19, Sacramentol. Go to www.greentechnology.org/gcsummit/

National Sustainable Design Expo
April 19-21, Washington, DC. Go to www.epa.gov/ncer/p3/nsde/index.html

2nd International Conference for NEXT GENERATION BATTERIES 2013
April 30 - May 1, Boston. Go to http://pgm-contact.php?act=evt&event_id=289

WINDPOWER 2013 Conference & Exhibition
May 5-8, Chicago. Go to www.windpower-expo.org/2013

Cleantech Conference & Showcase 3013
May 12-16, Washington, DC. Go to www.techconnectworld.com/Cleantech2013. Co-located with **TechConnect World Conference.**

21st Century Automotive Challenge
May 17-19, Penn State University, State College, PA. For information contact Joel Anstrom, janstrom@engr.psu.edu.

2013 EDTA (Electric Drive Transportation Association) Conference
June 1-12, Washington, DC. Go to http://electricdrive.org/edtaconferenceorg/

ITEC2013, IEEE- Transportation Electrification Conference and Expo
June 16, Dearborn, MI. Go to www.cvent.com/events/2013-ieee-itec/event-summary-7b49d949e898445cb6722 eea0873805f.aspx/

Alternative Clean Transportation (ACT) Expo
June 24-27, Washington, DC. For info go to www.actexpo.com.

15th Asian Battery Conference
Sept 1-13, Shangahi, China. Go to www.biz-tradeshows.com/conferences/abc/

Charging Infrastructure Expo
Sept 17-19, Detroit. Go to www.chargingexpo.com

Electric & Hybrid Vehicle Technology Expo
Sept 17-19, Novi, MI. Go to www.evtechexpo.com, collocated with **The Battery Show** (www.thebatteryshow.com) and **Charging Infrastructure Expo** (www.chargingexpo.com)

Plug-In 2013
Sept 30-Oct 3, San Diego. Go to plug-in2013.com

World Solar Challenge
Oct 6-13, Darwin, to Adelaide, Australia. For information go to www.worldsolar challenge.org/

EVS27
November 17-20, Barcelona. Go to www.evs27.org/

MEETING SCHEDULE

Meetings are held in Room 49, Plymouth-Whitemarsh High School, 201 East Germantown Pike in Plymouth Meeting, PA, and begin at 7:00 p.m. There will be no meetings in July or August.

Apr 10

May 8

June 12

September 11

October 9

ADVERTISEMENTS

For Sale: Zivan NG-3 Charger set up for 144 V Flooded battery pack $800

Curtis 1231C controller uprated to 200 V 640 A, cost $2000, sell for $1000.

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