EEVC NEWSLETTER

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Affiliated with EAA

GUEST SPEAKER AT NOVEMBER MEETING

Marielle Martin explains her research at the November EEVC Meeting.

At the November meeting Penn State student Marielle Martin gave a talk on her paper, "Analysis of California Senate Bill 1305: the Power Content Label, and its Application to Pennsylvania Electric Vehicle Charging Stations: Support, Opposition, and Recommendations"

Marielle, who is from just outside of Hershey, PA, will graduate from Penn State University this fall with a degree in Energy and Sustainability Policy. The final semester in this program involves a capstone project, in which students select an energy policy topic to research, write about, and present to a public audience — which in this case is the EEVC.

The issue, as Marielle explained it, is that consumers make decisions based on specific preferences. Regarding EVs, decisions on ownership and where to refuel may be affected by fuel choice preferences. However, Pennsylvania does not currently require that energy resource information be available to consumers at EV charging stations. In a state generating large percentages of electricity from coal, nuclear energy, and natural gas, providing this information would enable consumers to make more informed, personally satisfying decisions.

California Senate Bill 1305 requires electric utilities to disclose generation resources as percentages of the total generation mix. The percentages are reported to customers via a Power Content Label (PCL), which increases transparency and consumer awareness. The Califor-

nia Energy Commission states that the labels tell consumers "about the resources mix your energy dollars are being spent on." (California Energy Commission, 2015).

Interest in the program

Marielle chose the program for a number of reasons, she explains: "I make sustainable efforts in my personal life, like commuting by bicycle, eating a vegetarian diet, not using disposable food and drink receptacles, planning to build a 'tiny' home, etc. In addition, the program is offered entirely online, which meant I wouldn't need to worry about commuting. I hope to move to Colorado after graduation to pursue a career in sustainable design and development. I would love to work for a tiny house company, a consulting firm, or a company involved in LEED projects (Leadership in Energy and Environmental Design).

"My interest in electric vehicles came from an internship in 2014 with a consulting firm in Vermont. We worked with the state's government to improve public transit ridership and analyze transportation data.

"Speaking with EEVC members at the November meeting, Marielle reports, "has also sparked a possible interest in building an electric motorcycle, or purchasing one down the road at the very least. I was really impressed by how knowledgeable EEVC members are. More so, the EEVC was such a warm audience. I even got to test drive a Nissan LEAF after my presentation!"

Marielle's paper and presentation analyze the feasibility of applying PCLs from CA Senate Bill 1305 to Pennsylvania's EV charging stations. She presented an analysis of policy and explored support, and opposition, followed by a recommendation.

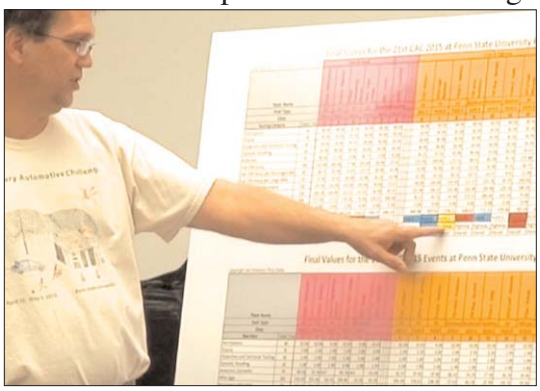
To learn more

An explanation of the California Energy Commission. Power Content Label can be found at www.energy.ca.gov/sb1305/power_content_label.html, and more on Senate Bill 1305 is at www.energy.ca.gov/sb1305/documents/SB1305REG.PDF.

Marielle's full report is available to Newsletter subscribers at https://dl.dropboxusercontent.com/u/47761169/EEVC%20Newsletters/Analysis%20of%20California%20Senate%20Bill%201305%20-%20Marielle%20Martin.pdf. Please do not post or give this address to non-members, or send copies of the report to anyone, as Marielle has restricted permission to EEVC members only.

21ST CAC AWARDS

Here are the results/awards for 21st CAC participants handed out by 21CAC director Joel Anstrom at the September EEVC meeting.



Dr. Joel Anstrom (Penn State Instructor and Researcher) director of the 21st Century Automotive Challenge, presents an over-all view of the competition and the rational behind the scoring system of the event.

A look at the categories

Competition in the 21st CAC, with many different types of vehicles competing, requires suitable classifications of vehicles. There are two main divisions that separate the Production Teams and Independent Teams. There are three sets of subdivisions to further define each group. One separates the Light Duty from the Heavy Duty. Another separates the cars capable of highway driving from those with limited range. Thirdly, the cars are also classified by adult passenger accommodation.

3.2.1 Vehicle Divisions

Production

This division is for all commercial manufacturers to demonstrate the capabilities of their vehicles. They will have the opportunity to compete with prototypes or vehicles currently being sold. We have chosen to have the production vehicles compete in a different division due to the funding difference between

the manufacturers and independents.

Independent
This group will be defined as any group of students or individuals that do not fall into the production division.

3.2.2 Weight Classes
Light-Duty
All vehicles less than 10,000 lb GVW (gross vehicle weight)

Heavy-Duty
All vehicles more than 10,000 lb GVW (gross vehicle weight)

3.2.3 Distance Capability
There will be a set of events in which both sets of sub-divisions compete. There will also be a set of events that are designed for each unique sub-division.

Local
Vehicles intended for local travel rather than long distance

Highway
Vehicles capable of long distance highway driving

3.2.4 Passenger Accommodation
Each vehicle will be placed into their final division depending on their adult passenger accommodation. The judges will have the final say on exactly how many seats each vehicle has.

1-2 Passengers
All vehicles that accommodate up to two adults

3-5 Passengers
All vehicles that accommodate between 3 and 5 adults

6+
All vehicles that accommodate 6 or more adults

Class Abbreviated Captions
ILL1-2 Independent Light Local 1-2 passengers
ILL3-5 Independent Light Local 3-5 passengers
PLL1-2 Production Light Local 1-2 passengers
PLL3-5 Production Light Local 3-5 passengers
ILH1-2 Independent Light Highway 1-2 passengers
ILH3-5 Independent Light Highway 3-5 passengers
PLH1-2 Production Light Highway 1-2 passengers
PLH3-5 Production Light Highway 3-5 passengers

There are 12 categories to score points in… Totaling 1000 pts

1. Participation	40 pts
2. Display	30 puts
3. Inspection and Technical Testing	30 pts
4. Dynamic Handling	30 pts
5. Autocross	70 pts
6. Fuel Efficiency	200 pts
7. Fuel Efficiency per passenger mile	50 pts
8. Fuel Efficiency per cargo mile	50 pts
9. Petroleum displacement	150 pts
10 Carbon Footprint	150 pts
11. Range	200 pts
12. Penalties	subtract
TOTAL	1000 PTS

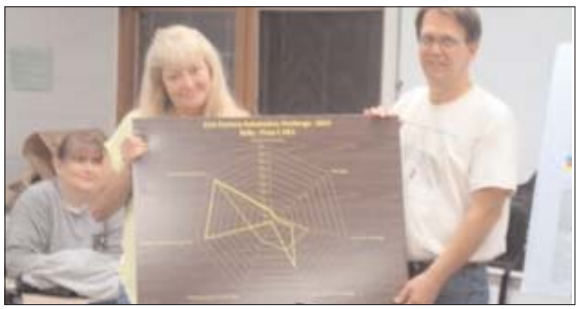
2015 21st CAC Scoring Results in Brief: Participants who attended the awards at Plymouth Whitemarsh High School Oct 14th

Denny Stichter (Shaker Engineering): Converted Ford Ranger. Lead Acid Battery Powered, Class A: Local (non-long highway). Third place In Class ILL1-2 (Denny unfortunately suffered a motor commutator failure while driving a local route and could not finish the competition nor compete in the autocross.). Total toints out of 1000: 682

Dr. Paul Kydd: Hybridized F-150 pickup truck, Class A, Local (non long highway), first place In Class ILL3-5; total points out of 1000: 430

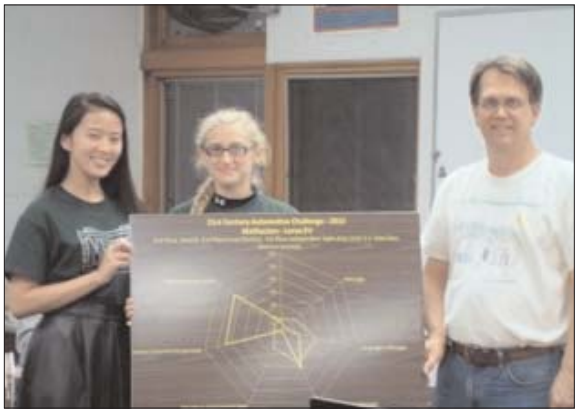
Jurgen Balitzky: Tesla Model S, Class B, Highway, third place in Class PLH3-5, Third Place, Highway Division, total points out of 1000: 776

Alan Arrison: Converted S-10 Chevy professional built pick up truck, Class: B Highway, First Place: In Class ILH1-2, total points out of 1000: 689



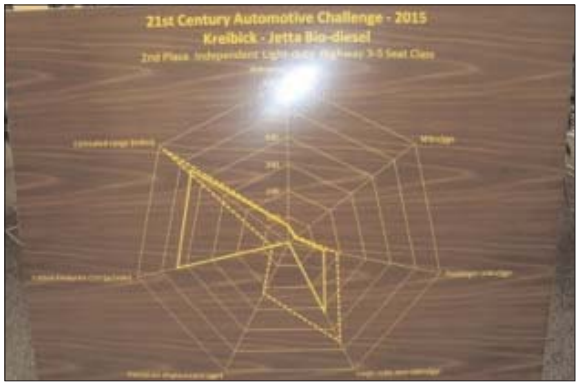
Denys Kelly: Prius C, Class B: Highway, Sub-class PLH3-5, total points out of 1000: 570

Dan Monroe: Nissan Leaf, Class B, Highway, Second Place in Class PLH3-5, second Place in Highway Division, total points out of 1000: 787



Methacton High School: Converted 3 wheeled Lorax, lead acid battery powered, Class A: Local, First Place in Class ILL1-2, Second Place In Local Division, Third Place Overall, total points out of 1000: 795

Ken Barbour: Nissan Leaf, Class B, Highway, First Place in Class PLH3-5, First Place in Highway Division Battery Electric, tied for First Place Over-all with 830 points out of 1000



Ed Kreibick:: VW Jetta Bio-Diesel (Ed not pictured), Class B: Highway, Second Place in Class ILH3-5, total points out of 1000: 639

The 2015 21st CAC Results included individual competitors and teams who were not present at the EEVC meeting at Plymouth Whitemarsh High School October 14th. Joel presented plaques only to those who attended our meeting.

Two individuals, both of whom competed at Penn State, joined the EEVC at the competition. Both of these competitors performed very well but were unable to attend the Awards Meeting:

Cory Rideout, from Penn State (far left): Vectrix Electric Motorcycle, First Place in Class PLL1-2, First Place in Local Division, tied For First Place Over-all with 830 points out of 1000

Jonathan Bartlett (front left): TDI Bug (VW), First Place in Class ILH3-5, Winner of the Autocross of both ICE and Electric Vehicles, total out of 1000 pts: 772.

Cory and Jonathan are presently EEVC members. In order to be eligible for EEVC Top Gun Awards participants must be members of the EEVC when they register for the event. They cannot receive EEVC awards if they join the EEVC after they register for the 21st CAC.

One more (non EEVC member) participant in the 2015 21st CAC worthy of mention:

Penn College: Converted Battery Powered Fiero, Second Place in Class ILL1-2, total points out of 1000: 714.

Special Thanks to Aimee and Denys For Attending

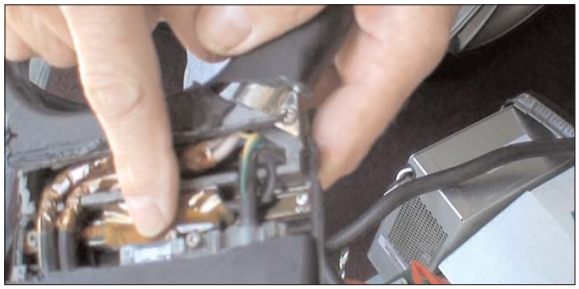
Aimee Barbour and Denys Kelly helped serve refreshments after the meeting. Not that women are seldom seen at our meetings, but we certainly encourage more to attend.

OLLIE'S TRIP TO CALIFORNIA

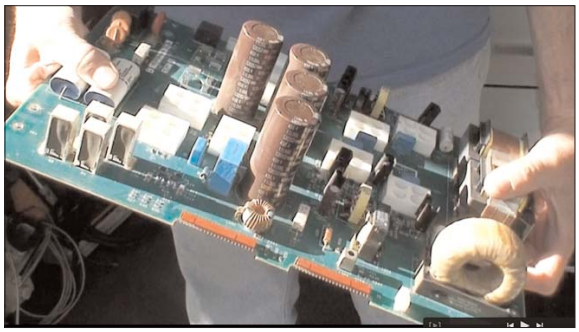
On his recent West Coast trip Ollie and Dottie Perry stopped to visit Ron Fruend, Chairman of the EAA board. Ron has recently retired from Hewlett Packard and is spending a lot of his time helping to fix charging stations that were used in some of the induction charging vehicles (GM initiated) going back to the 90s era.

Ron Freund welcomes Oliver Perry, pres of EEVC, and his wife to his garage in Southern California.

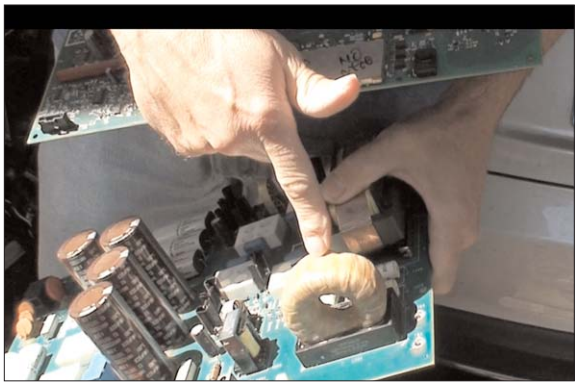
Ron (besides owning a Tesla S) maintains a Toyota Rav 4 converted SUV. He is presently refurbishing induction charging station units for vehicles like the Rav 4. Notice the induction paddle he is holding.



Ron points to an exposed infrared beam component in the paddle.



Ron holds up the electronic circuit board taken from one of the charging stations. These off board stations link the home circuitry to the charging receptacle of the vehicle. The system allows for shock proof charging no matter what the circumstances might be or how careless the driver happens to be when plugging in.



Ron points to an induction coil that gets hotter than 250 ºF. He can frequently troubleshoot these boards by using a heat sensor that can indicate whether or not the component is working. No heat (a cold heat sink) can indicate that an item like a transistor is not working.

NEWS UPDATE

500 Wh/kg?

Research on better batteries seems to be moving along at a steady pace. The ALISE project, a European collaboration focused on lithium sulphur battery technology, recently announced that two British firms, the electrical and electronic design consultancy and prototyping RDVS and OXIS Energy UK, have been working closely together on the ALISE project, whose target is to develop lithium sulfur technology to 500Wh/kg with 2000 cycle life by 2019. So far, according to OXIS Energy CEO Huw Hampson-Jones, they have reached 325 Wh/kg.

Lithium-Sulfur presents multiple challenges, including physical changes to the cathode during charge and discharge. Other research on LI-S has been going on at Lawrence Berkeley National Laboratory, which as far back as 2013 was demonstrating 500 Wh/kg and 1500 cycle life in the laboratory, according to an article by Brian Dodson in Gizmag (www.gizmag.com/lithium-sulfur-battery-energy-density/29907/).

Another contender: Li-air

At the same time research continues on lithium-air technology. University of Cambridge researchers have made significant progress in overcoming some of the obstacles that had been limiting a technology that showed promise of overcoming some of previ-

ous obstacles. According to the university, "Scientists have developed a working laboratory demonstrator of a lithium-oxygen battery which has very high energy density, is more than 90% efficient, and, to date, can be recharged more than 2000 times, showing how several of the problems holding back the development of these devices could be solved.

"Lithium-oxygen, or lithium-air, batteries have been touted as the 'ultimate' battery due to their theoretical energy density, which is ten times that of a lithium-ion battery. Such a high energy density would be comparable to that of gasoline — and would [make possible] an electric car with a battery that is a fifth the cost and a fifth the weight of those currently on the market to drive from [Philadelphia to Buffalo] on a single charge.

"However, as is the case with other next-generation batteries, there are several practical challenges that need to be addressed before lithium-air batteries become a viable alternative to gasoline.

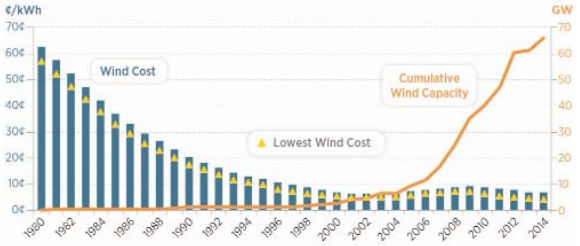
"Now, researchers from the University of Cambridge have demonstrated how some of these obstacles may be overcome, and developed a lab-based demonstrator of a lithium-oxygen battery which has higher capacity, increased energy efficiency and improved stability over previous attempts.

"Their demonstrator relies on a highly porous, 'fluffy' carbon electrode made from graphene (comprising one-atom-thick sheets of carbon atoms), and additives that alter the chemical reactions at work in the battery, making it more stable and more efficient. While the results, reported in the journal *Science*, are promising, the researchers caution that a practical lithium-air battery still remains at least a decade away."

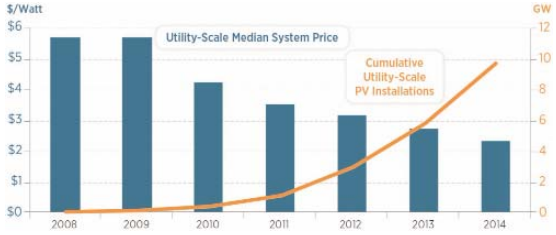
DoE cites progress

A report from the Department of Energy points out that progress on the renewable energy front over the past few years has been remarkable.

Wind installations are now at more than 65 gigawatts (GW) of installed capacity with another 13.6 GW of capacity in development. This means that wind is poised to overtake hydroelectric power as America's number one source of renewable energy. Wind power accounts for 4.4 percent of total U.S. electric generation and reduces annual carbon dioxide emissions by 115 million metric tons. The chart below shows how the installed total has moved inversely to the price per watt over the years:

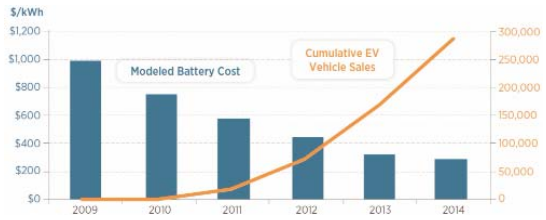


Similarly, utility-scale photovoltaic (PV) dropped has dropped from $5.70 per watt of generating power in 2008 to only $2.34 per watt in 2014, a reduction of almost 60 percent, resulting in an increase in installed capacity from almost none in 2008 to nearly 10 GW in 2014, with 27 GW of utility-scale solar projects currently in development.



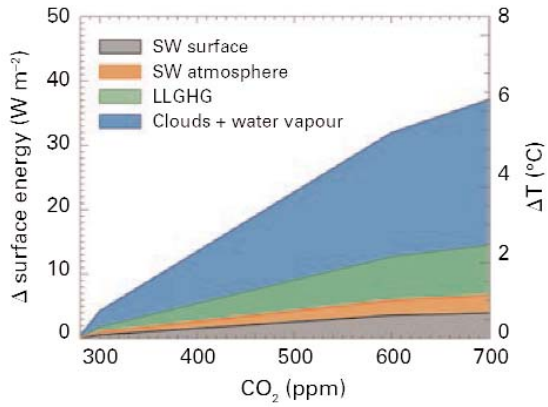
Rooftop PV has also grown rapidly, says the report. Costs have been halved since 2008, and capacity has grown from less than a GW of production to nearly 10 GW in late 2015, which represents almost 800,000 installations:

And EV ownership has continued to increase, with nearly 300,000 EVs put on U.S. roads in just six years:



How much CO_2?

All this is nice, but one wonders if it is too little, too late. The latest analysis of observations from the World Meteorological Organization (WMO) Global Atmosphere Watch Program shows that the globally averaged mole fractions of carbon dioxide, methane and nitrous oxide reached new highs in 2014, with CO_2 at 397.7 ppm, CH_4 at 1833 ppb and N_2O at 327.1 ppb. These values constitute, respectively, 143%, 254% and 121% of pre-industrial (1750) levels. The atmospheric increase of CO_2 from 2013 to 2014 was close to that averaged over the past ten years. For both CH_4 and N_2O the increases from 2013 to 2014 were larger than that observed from 2012 to 2013 and the mean rates over the past ten years. The National Oceanic and Atmospheric Administration (NOAA) Annual Greenhouse Gas Index shows that from 1990 to 2014 radiative forcing by long-lived greenhouse gases (LLGHGs) increased by 36%, with CO_2 accounting for about 80% of this increase:



Water vapor (blue above) is also a greenhouse gas, and it increases with increasing CO_2 levels.

Will EVs help?

On September 17 the Electric Power Research Institute (EPRI) and the Natural Resources Defense Council (NRDC) released an analysis that finds widespread adoption of electric transportation, including electrification in the off-road sector, could lead to substantial reductions in greenhouse gas (GHG) emissions and could improve air quality.

The report, "Environmental Assessment of a Full Electric Transportation Portfolio," (http://epri.co/3002006881) projects GHG emissions through 2050 and air quality impacts in 2030. It finds that greenhouse gas emissions from light-duty vehicles could drop as much as 64 percent below today's levels. Widespread use of EVs — including lawn and garden equipment and heavy industrial equipment such as forklifts — could improve air quality, particularly in densely populated urban areas.

Use of electric vehicles would achieve greater reductions in GHG emissions, corresponding to the rate that the electric grid becomes cleaner, through greater reliance on renewables and low- and non-emitting generation.

Is there a Faraday in your future?

A November 6 story by Andy Szal in *Manufacturing.net* reports that aspiring EV maker Faraday Future has "announced plans to build a billion-dollar factory in order to begin producing cars in 2017." The company, which has not revealed where it plans this factory, hopes to challenge Tesla for a chunk of the high-end EV market. It is headquartered in Gardena, CA in the L.A. area and is apparently backed by Chinese multibillionaire Jia Yueting

There is speculation that the company is planning an unusual business model, such as subscription or shared ownership, according to the *L.A. Times*.

Renewable Power Economic Potential Has More Than Tripled

From Office of Energy Efficiency and Renewable Energy (EERE):

The promise and appeal of renewable energy has long been clear: clean, inexhaustible, domestically sourced electricity could lead to enormous environmental, economic and resiliency benefits. For many years, the narrative included the caveat "…but it's too expensive." That story is changing fast, however, thanks to falling renewable energy technology

costs, which should help renewable energy continue to grow across the United States.

In fact, analysts at the Energy Department's National Renewable Energy Laboratory (NREL) have applied a new method that shows renewable generation is economically viable in many parts of the country, because of the recent rapid decline in the costs of technology.

A recent report released by NREL, Estimating Renewable Energy Economic Potential in the United States: Methodology and Initial Results, describes the new geospatial analysis method used to estimate the economic potential of several renewable resources. Economic potential is a metric that quantifies the amount of economically viable renewable generation that is available at a specific location. Analysis to date includes photovoltaics (PV), wind, geothermal, biomass and hydropower resources.

Assessing the potential at feasible sites, the report found that when the social cost of carbon is taken into account, renewable generation is economically viable in many parts of the country. At 2014 costs, renewable energy technologies combine for 820 terawatt-hours (TWh) of estimated economic potential beyond the generation from renewable energy facilities already in operation. This additional potential is equivalent to nearly 20 percent of total U.S. annual electricity generation from all sources in 2014 – compared to 2010 costs when only 250 TWh were identified. In just four years, thanks to falling renewable energy technology costs, economic potential has more than tripled.

The trend is likely to continue as we deploy more renewable energy and continue driving down costs. With projected renewable energy costs in 2020 and 2030, economic potential increases considerably. At 2020 costs, economic potential equals almost half of U.S. annual electricity demand, and 2030 costs bring that number to over 75% with the potential for cost-effective renewable energy to be generated in every state in the country.

As this study shows, with continued cost improvements, renewable energy's potential in the United States may not quite be unlimited, but it certainly is enormous.

DON'T GET CRABS
By California Pete

An important tradition here in the Bay Area is to feast on fresh-caught dungeness crab on Thanksgiving. Each fall the season opens and crab boats head out into the Pacific from Fisherman's Wharf and other places to drop traps and come back with the big crawly beasts. This year's El Niño event, while it promises help with the drought, has warmed the ocean enough that there has been a massive bloom of the marine diatom Pseudo-nitzschia, which produces the neurotoxin domoic acid. The poison accumulates in crabs and other creatures, and can have severe effects. It kills or injures things, like seals, that live higher on the food chain, and that includes humans. Enough has accumulated in the crabs that they have been declared unfit to eat, which is bad news for the fishermen. Consumers can still get crabs for their holiday feast, as they've been shipped in from Oregon and Washington where the waters are colder, but an important local industry is badly hurt. And we just received word that, while Bay Area waters are clearing up it will be too late for the holiday, while Oregon and Washington waters may soon be closed.

For those who simply must have a San Francisco culinary tradition to observe, it's still possible to whip up a batch of cioppino (look it up), which can be made without crab if necessary.

It's mudslide season

While crab season may not be happening this year, mudslide season definitely is. In October a flash flood and mudslide (which occurred before the beginning of the normal rainy season) buried parts of I-5 75 miles north of Los Angeles near Tejon pass (informally referred to as the Grapevine, for the small town that lies on the flatland ten miles to the north and 1500 feet lower) under as much as five feet of mud. The same storm closed a nearly eight-mile section of Highway 58 east of Tehachapi, stranding as many as 200 vehicles in mud. But the really heavy rains from El Niño won't hit until January, so we still have a

little time to not prepare.

Come to the sideshow

Oakland is (dare I say it?) gentrifying, but some local traditions remain strong, as evidenced by a November 15 sideshow, the biggest in a long time, which featured hundreds of cars — some from as far away as Los Angeles — doing spins, burnout and doughnuts on a shut-down section of I-880 in the middle of the night. The nine-hour event, which spread to multiple venues, featured a state police helicopter hovering overhead as shot were fired at it, participants jumping up and down on a police car whose occupants had fled for their lives, and one fatality (a man approached the police as they were towing away vehicles after the event, pointing what turned out to be a fake gun). There have been no arrests.

The real S.F. is vanishing before our eyes

Nobody can deny that San Francisco has its quirky side, but it seems increasingly clear that, more than Oakland and more like New York, those things that made San Francisco unique are being homogenized out of existence, with nothing left but trendy places for the newly rich. No more dive bars? No more smelly neighborhoods? How can it be, yet it's happening. See the latest on the problem at http://www.sfchronicle.com/bayarea/nativeson/article/S-F-has-hit-tipping-point-but-other-cities-6575813.php.

Well, one smelly thing remains: There are as many (or more) homeless as before, and no one knows what to do about them.

COMING EVENTS

Webcast: SAE International J3061 — The World's First Standard on Automotive Cybersecurity, A Global Discussion
Dec 3, 9:00 a.m. EST. file:///C:/Documents%20and%20Settings/All%20Users/Documents/Nov%2015%20Newsletter/Events/SAE%20International%20J3061%E2%84%A2%20%E2%80%93%20The%20World%E2%80%99s%20First%20Standard%20on%20Automotive%20Cybersecurity%20%E2%80%93%20A%20Global%20Discussion%20-%201080592.htm

Seminar: EPA's Clean Power Plan: Knowledge is power
Dec 2, Milwaukee, WI. www.gklaw.com/news.cfm?action=sem_display&event_id=1051

SAE International Vehicle Electric Powertrain Forum
Dec 3-4, Shanghai, China. Go to https://www.sae.org/events/vept/

SAE 2016 Hybrid & Electric Vehicle Technologies Symposium
Feb 9-12, Anaheim, CA. www.sae.org/events/hybridev/

2016 Clean Low-Carbon Fuels Summit
Feb 23, Sacramento, CA. file:///C:/Documents%20and%20Settings/All%20Users/Documents/Nov%2015%20Newsletter/Events/CALSTART%20Events%20%29%202016%20Clean%20Low-Carbon%20Fuels%20Summit.htm

SAE 2016 World Congress & Exhibition
April 12-14, Detroit. www.sae.org/congress/

WAVE TROPHY 2016 ++ 11 - 19 JUNE 2016
June 11-16, from the North Sea into the Alps. www.wavetrophy.com/en/

2016 American Solar Challenge
July 22 - Aug 6, traveling through seven states from Brecksville, OH to Hot Springs, SD. http://americansolarchallenge.org/the-competition/ascfsgp-2016/

NOTICE ON DUES

Annual EEVC dues are $20 with electronic delivery of the Newsletter, or $25 for a printed copy. Mail checks payable to EEVC to James Natale, 3307 Concord Dr, Cinnaminson NJ 08077, or pay via PayPal to jnatalemicro@comcast.net.

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.

Dec 9

Jan 13

Feb 10

Mar 9

Apr 13