

EEVC NEWSLETTER


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NIKOLA MOTOR COMPANY, THE TESLA OF ELECTRIC TRUCKING Oliver Perry

Finally we are reading about a possible near term reality of hybrid technology being applied in the massive tractor-trailer business. The amount of fuel it takes to drive these mammoth vehicles down the road is enormous... about 6 mpg.

Nikola Motor Company is a premium electric vehicle company. The Nikola One hybrid natural gas/electric tractor trailer was set to launch a prototype in December 2016. The company had pre-sold more than 7,000 of its revolutionary hybrid long-haul truck cabs, promising technology that would save around 117,000 gallons of fuel per rig. (I am assuming over its lifetime?) *Burlington County Times*, Friday July 22nd, 2016, page D6. The article was written by Evelyn Kanter of Motor Matters.

In addition to building the revolutionary new tractor trailer, Nikola planned to build



The Nikola One (hydrogen-powered version)

more than 50 CNG (compressed natural gas) stations nationwide, spaced at around 500 mile intervals. Fully loaded this CNG hybrid, the Nikola One, was expected to average 15 miles per gallon better than a diesel-powered 18 wheel-

er and — if we can believe it — the operating costs will be half that of traditional rigs. The author claims that the company believes that by ditching the heavy diesel engine its one ton lighter weight would allow it to haul more freight, adding \$1000 per load in revenues.

The prototype is a series-hybrid with six in-wheel 800 Volt electric motors that produce 2000 horsepower, four times that of a conventional diesel tractor engine. The tractor would have a generator to charge the batteries.

Nikola is a privately held company that owns natural gas wells in the U.S. and Cana-

da. It designs, manufactures, and sells electric energy storage systems and EV drive trains. Trevor Milton, the founder and CEO, is not a well known name in the business yet.

The natural gas engine, the power source, was not described in the article.

Those of you who enjoy exploring the internet to find out details may have an enjoyable time researching this. I find it very hard to believe. Nikola, which is based in Salt Lake City claims an impressive \$2.3 Billion in reservations based upon the full price tag of \$375,000 per tractor. Some 7000 hopeful customers have plunked down \$1500 each to pre-order a vehicle which might not be available until 2020.

Another look



Nikola Two

(Intrigued by the material above, we looked to see what later information might be available — ed)

The Nikola Web site (<https://nikolamotor.com>) now shows the Nikola One as powered by hydrogen fuel cells, rather than a CNG-fueled turbine. Claims for the vehicle include zero emissions, 800 to 1200 mile range, 15 minute refill time and half the operating cost compared to diesel. Other claims are the same as those for the CNG version: 2000 ft-Lb torque, 1000 hp, 320 kWh battery and so on. Fuel consumption is listed as 13-15 mpg, compared to 7.5 mpg for a comparable diesel truck. And there is one other claim: 1 million miles worth of free hydrogen (similar to that for the Toyota Mirai's three years of complimentary fill-ups (see the September, 2016 issue).

There is also another model, called the Nikola Two, which seems to differ primarily in that it has a day cab, rather than the

extended sleeper of the Nikola One.

A FEW THOUGHTS ON RECENT EVENTS

Oliver Perry

Let me begin with this thought: "First let me manage my own emotions in regard to emotional laden issues before I try to straighten out others."

I would like to refer to several very well-written articles that appeared in the weekend edition (Aug 12-13 Sat Sun) *Wall Street Journal*: "The Liberal Crack Up" by Mark Lilla and "Why I was Fired by Google," by James Damore.

Dr. Mark Lilla, professor of the humanities at Columbia University, asks the question, "Why would those who claim to speak for and defend the great American demos (the common people of an ancient Greek state. ... the populace as a political unit, especially in a democracy) be so indifferent to stirring its feelings and gaining its (public) trust?" "We liberals must develop a new ambitious vision of America and its future that will again inspire people of EVERY WALK OF LIFE and in EVERY REGION OF THE COUNTRY to come together as citizens."

"Even when they vote for Democrats or support some of their policies, most Americans — including young people, women, and minorities, reject the the term liberal. And it isn't hard to see why. They see us as aloof, elitist, out of touch.

"We must relearn how to speak to citizens as citizens and to frame our our appeals for solitary including ones to benefit particular groups in terms of principles that everyone can affirm. The more that differences between ourselves and others are emphasized the less likely I will feel outrage for how those on the other side (singled out by my group for mistreatment) have been wronged."

"For those students who will soon become liberal progressive elites, the line between self-discovery and political action have become blurred. Their political commitments are genuine but are circumscribed by the confines of their self definitions. Issues that penetrate those confines take on looming importance, and since politics for them is personal, their positions tend to be absolutist, and non-

negotiable...classical liberal ideas like citizenship and common good have little meaning to them.”...”And they are less and less comfortable with debate.”

“Classroom conversations that once might have begun with, ‘I think A and here is my argument,’ now take the form; ‘speaking as an X, I am offended that you claim B!’ What replaces argument, then, are taboos against unfamiliar ideas and contrary opinions.”

Now let’s go to the article “Why I Was Fired By Google.”

James Damore set out to produce a 10 page well-researched, good-faith, argument. He stated that in his opinion not all disparities between men and women that we see in the world are the result of discriminatory treatment. But, instead of respecting his position, as well as that of the rest of mankind, (that we have differing moral preferences and beliefs about how the world is and should be), Google chose to express intolerance over Damore’s views rather than respect them.

James Damore was fired because portions of a document he circulated throughout the company, which ended up on the internet, violated the company’s code of conduct and crossed the line by advancing harmful gender stereotypes in Google’s workplace. “Google like many other companies and political parties) has become like a cult with its own leaders and saints, all believed to righteously uphold the sacred motto of DON’T BE EVIL.”

Such organizations “maintain themselves by creating a shared spirit and keeping discussion confined within certain limits.” “They have to guard against dissent and opposition. whether it’s in our homes, online, or in our workplaces, a consensus is maintained by shaming people into conformity or excommunicating them if they persist in violating taboos. Public shaming serves not only to display the virtue of those doing the shaming but also warns others that the same punishment awaits them if they don’t conform.

Damore states that we “tend to avoid people with differing values and to associate with those who share our values. This self-segregation has become much more potent in recent decades. We are more mobile and can sort ourselves into different communities; we wait longer to find and choose just the right

mate; and we spend much of our time in a digital world personalized to fit our views.” If Damore is correct then we may be setting ourselves up to becoming even more intolerant toward another person’s point of view and engaging them in reasonable debate.

Damore (the engineer fired) asks the question, “How did Google, the company that hires the smartest people in the world, become so ideologically driven and intolerant of scientific debate and reasoned argument?”

Application of the message

It reminds me of the famous saying by Pogo: “We have met the enemy and he is us!”

How do we feel about those who deny climate change? Should they be fired from their jobs and blacklisted?

How do we feel about those who prefer gasoline cars to electric ones? Those who prefer Trump to Clinton?

How sure are we of our political correctness? Is everyone on the opposite side from our view totally wrong; a self centered greedy liar? Are those who disagree with us all stupid?

Do we really want to exterminate our opposition? If so, let’s say goodbye to reason and join our comrades in the street.

DEVELOPING HIGH ENERGY-DENSITY BATTERIES FOR EVS

By Stuart Birch, from the SAE International Web site, <http://articles.sae.org/15540/>

It’s been a long road for Nissan from its 1947 Tama EV to its advanced prototype ZEV BladeGlider sports car, but that road still stretches to — and far beyond — the technology horizon, as it continues to refine electric propulsion solutions.

The company claims world leadership in ZEV technology following the 2010 introduction of the Leaf EV, the first modern-era battery-electric passenger car. The second generation Leaf will make its premiere in September.

As previously reported in *Automotive Engineering* (<http://articles.sae.org/14604/>), Nissan Europe is leading a U.K. consortium to research and develop future generation batteries via the High Energy Density Battery (HEDB) project. Its aim is to deliver multi-

functional battery systems for EVs and HEVs. Nissan manufactures EV battery packs at its Sunderland, U.K. plant.

The consortium will embrace pilot projects, product diversification and process improvement. A key member is Hyperdrive Innovation, whose founder and Commercial Managing Director, Stephen Irish, spoke recently with [*Automotive Engineerin*]. He noted that while substantial improvements in cell chemistry have been made in recent years, “there is no magic solution regarding enhancing energy density.” However, he sees potential for pack-level improvements through the consortium as well as the Battery Management Systems (BMS) developed by Hyperdrive to ensure cell longevity and efficiency while accommodating “opportunity charging.”

Vital to battery development work is understanding the duty cycles of specific vehicle types as well as cost, said Irish: “We ask ourselves where best value will be achieved — how, and how frequently, a vehicle or machine is to be used, how it’s charged, where the energy comes from.” Making that energy go further concerns vehicle weight and power electronics and how they work.

“While Hyperdrive’s focus is BMS development, novel chemistry solutions need to be considered, too. The company has recently worked with lithium sulfur which, in theory, can deliver specific energy density that is five times that of lithium-ion. However, Li-S is still in development “and in the real world it could be less,” Irish said.

“We are not chemists but we do need to know about these developments to spot trends and to be able to develop our technologies and absorb them into our products,” he explained. “For us, just as for an OEM, there has to be a clear route to market.”

Battery size matters

Sometimes, that market is complicated by what Irish terms “extreme outliers” — users who care less about a battery’s life and just want to max up-time and extract as much energy as possible from it and also charge it as quickly as possible. The other extreme concerns users who require optimal longevity for the battery and its associated electronic systems, to achieve best possible value over time.

“Personally, I would argue for the smallest

battery possible for a daily commuting vehicle, saving weight and cost. Most people do not drive as far in a week or month as they think they do,” Irish said. “However, it is still the market barrier of increased range that end-users want. It has to be overcome.”

Typical EV battery life expectancy is 5000 to 6000 cycles at consistent 80% discharge rates, Irish noted. Taking it to 100% discharge cuts its life by two-thirds, he said, adding that secondary re-use applications will help harvest maximum value from the cells.

Getting battery and BMS costs down is a constant battle. Achieving economies of scale is significant; supporting this is designing for commonality. “If we do bespoke systems we have to pass on non-recurring engineering costs, which can be substantial in terms of tooling and validation testing,” Irish explained. A more standard suite of products, as Hyperdrive has created, allows on-costs to be reduced while enabling faster time-to-market.

Hyperdrive also has designed a modular universal battery suitable for commercial vehicles and some off-highway applications. Together with Douglas Equipment, part of Textron, the company has developed a push-back mild hybrid tractor.

Low-temperature research

A particular area of concern for EVs is low-temperature operation. To gain experience, Hyperdrive carried out a project with the British Antarctic Survey team. Batteries were non-traction types with low current applications. The research aim was to learn as much as possible about battery and associated systems’ performance at temperature extremes of around -50 °C. ICEs have problems at very low temperatures and need overnight engine heating.

Irish is confident of EV performance meeting low temperature challenges, albeit not down to extreme levels. “And an electric vehicle charging overnight will be warm in the morning with comfortable cabin and clear windshield.”

Hyperdrive’s BMS has been developed to take account of temperature; it actively controls charge and discharge of the battery cells to obviate potential damage but thermal management would be needed in some applica-

tions, said Irish.

Following a broad range of engineering experience, including development projects at Jaguar Land Rover and NSK Steering Systems, Irish established Hyperdrive five years ago. Its partnership with Nissan includes installation of high performance systems incorporating Nissan cell technology into various EV and battery energy storage systems. Other consortium members are: Warwick Manufacturing Group, University of Warwick; Newcastle University; and Zero Carbon Futures.

NEWS UPDATE

Is the ICE dead — or doomed?

An article in the August 18 issue of *The Economist* entitled “The death of the internal combustion engine” looks at the rapid pace of EV introductions from multiple manufacturers and suggests that “[t]he shift from fuel and pistons to batteries and electric motors is unlikely to take as long as the national pronouncements on adoption of EVs demand (“Last month Britain joined a lengthening list of electric-only countries, saying that all new cars must be zero-emission by 2050”). As a result, the article continues, automakers, seeing the simplicity of EVs compared to ICE vehicles, may begin to lay off more and more workers — to the point that only the strongest companies may survive. On top of that, the spread of Transportation as a Service may reduce overall vehicle demand.

There will be other changes as well: reduced demand for petroleum and further increase in the price for lithium and rare earth elements (used in motors).

“The internal combustion engine has had a good run — and could still dominate shipping and aviation for decades to come. But on land electric motors will soon offer freedom and convenience more cheaply and cleanly. As the switch to electric cars reverses the trend in the rich world towards falling electricity consumption, policymakers will need to help, by ensuring that there is enough generating capacity — in spite of many countries’ broken system of regulation. They may need to be the midwives to new rules and standards for public recharging stations, and

the recycling of batteries, rare-earth motors and other components in ‘urban mines.’ And they will have to cope with the turmoil as old factory jobs disappear.

“Driverless electric cars in the 21st century are likely to improve the world in profound and unexpected ways, just as vehicles powered by internal combustion engines did in the 20th. But it will be a bumpy road. Buckle up.”

Army discovery may offer new energy source

By David McNally, ARL Public Affairs
<http://www.arl.army.mil/www/default.cfm?article=3036>

Army scientists and engineers recently announced that an aluminum nanomaterial of their design produces high amounts of energy when it comes in contact with water, or any liquid containing water.

During routine materials experimentation at the U.S. Army Research Laboratory, a team of researchers observed a bubbling reaction when adding water to a nano-galvanic aluminum-based powder.

The team found that water splits apart when coming into contact with the material.

The reaction surprised the researchers, but they soon considered its potential implications for future power and energy applications.

“The hydrogen that is given off can be used as a fuel in a fuel cell,” said Scott Gren Dahl, a materials engineer and team leader. “What we discovered is a mechanism for a rapid and spontaneous hydrolysis of water.”

Scientists have known for a long time that hydrogen can be produced by adding a catalyst (a substance that increases a chemical reaction rate) to aluminum. But these methods take time, elevated temperature, added electricity, and/or toxic chemicals such as sodium hydroxide, potassium hydroxide, or acid.

“In our case, it does not need a catalyst,” Giri said. “Also, it is very fast. For example, we have calculated that one kilogram of aluminum powder can produce 220 kilowatts of energy in just three minutes.”

That metric doubles if you consider the amount of heat energy produced by the exothermic reaction, he said.

“That’s a lot of power to run any electrical equipment,” Giri said. “These rates are the fastest known without using catalysts such as an acid, base or elevated temperatures.”

The team demonstrated a small radio-controlled tank powered by the powder/water reaction. Moments after mixing the powder with a small amount of water, a bubbling reaction produced a great deal of hydrogen, which was then used to power the model around the laboratory.

“We just take our material, put it in the water and the water splits down into hydrogen and oxygen,” Grendahl said.

“There are other researchers who have been searching their whole lives and their optimized product takes many hours to achieve, say 50 percent efficiency,” Grendahl said. “Ours does it to nearly 100 percent efficiency in less than three minutes.”

Additionally, since the nanomaterial powder has the potential to be 3-D printed, researchers envision future air and ground robots that can feed off their own structures and self-destruct after mission completion.

Researchers said one possible application of the discovery that may help future soldiers is the potential to recharge mobile devices for recon teams.

The next steps are to document the discovery with scholarly papers and intellectual property protections, some of which are ongoing, and to coordinate further applications with scientists and engineers across the laboratory.

Power-to-liquid: 200 liters of fuel from solar power and the air’s carbon dioxide

The Soletair project has announced the production of its first 200 liters of liquid fuel using solar energy and carbon dioxide from the air by Fischer-Tropsch synthesis. The mobile chemical pilot plant that can be used decentrally produces gasoline, diesel, and kerosene from regenerative hydrogen and carbon dioxide.

The pilot plant has a production capacity of up to 80 l of gasoline per day. In the first campaign now completed, about 200 l of fuel were produced in several phases to study the optimum synthesis process, possibilities of using the heat produced, and product properties. The compact plant- designed for decen-

tralized production, fits into a shipping container, and can be extended modularly.

Bollinger Motors shows B1 Electric Sport Utility Truck



On July 27 Bollinger Motors unveiled its all-electric B1 sport utility truck. Aside from the macho styling, it features an aluminum chassis with a high-strength, low-alloy (HSLA) steel rollover structure, a wheelbase of 105 inches, front and rear track of 68 inches, an approach angle of 56 degrees, departure angle of 53 degrees, and break over angle of 33 degrees — suitable for off-road use. The base ride height provides for 15.5 inches of ground clearance but will be adjustable using a self-leveling, 4-wheel independent, hydro-pneumatic suspension within the 10 inches of wheel travel. Disconnectable anti-roll bars allow traction enhancing, full suspension articulation during off-road maneuvers.

The power system delivers 360 hp and 472 lb-ft of torque, with a 0-60 time of 4.5 seconds and a top speed of 127 miles per hour. Overall weight is 3900 lbs and payload capacity is 6,100 lbs, for a gross vehicle weight rating (GVWR) of just over 10,001 lbs. The vehicle has a dual-motor configuration using front- and rear- mounted motors. The production version will offer two lithium ion battery pack options: 60 kWh or 100 kWh, producing either 120 miles or 200 miles in range.

Pricing and manufacturing targets are expected to be announced later this year, using a direct-to-consumer sales model at first, with company and retail stores in major cities across to come later. In early 2018 reservation holders will be able to order their B1 with a \$1,000 down payment.

More information is available at <http://bollingermototr.com>

Remember rechargeable alkaline batteries?

An August 1 article by John Markoff in the *New York Times* reports that a startup called Ionic Materials (Woburn, MA) has developed technology that promises to make rechargeable alkaline batteries competitive with lithium-ion, at lower cost and with better safety and lifetime. “So far, the company ... has demonstrated up to 400 recharge cycles for its prototypes. Ionic executives say they believe they will be able to triple that.” While they have less energy density than lithium, they don’t use cobalt or other hard-to-get or expensive materials — just zinc and manganese. We’ll have to see what comes of it.

Upcoming lithium shortage?

Speaking of lithium, an August 7 Reuters article reports on predictions that lithium demand will exceed production capacity by 26,000 tons of lithium carbonate equivalent by 2025. The price of the metal has been rising steadily, from \$4000 per tonne in 2011 to about \$9000 in 2017. The Reuters article has a fair amount of information for people who might like to play in that market; it’s at <https://www.autoblog.com/2017/08/07/lithium-processors-risk-shortfall-as-ev-batteries-quadruple-demand/>

Nissan selling battery business to Chinese

An August 8 Reuters article by Chris Gallagher and Chang-Ran Kim reports that Nissan “has agreed to sell its electric battery business to Chinese investment firm GSR Capital.”

“Nissan has been selling stakes in non-core businesses to focus on developing technology including electric powertrains and autonomous driving.”

Faraday Future leases factory space in CA

An August 7 *Autoblog* article by John Beltz Snyder reports that Faraday Future, which had recently cancelled plans for a factory in the Las Vegas area, has signed a lease for a 1 million square foot facility in Hanford, CA. “Eventually,” says the article, “the company plans to employ 1300 workers over three shifts at the facility. Its first vehicle, the Faraday Future FF91, is scheduled to go to market in late 2018.” We’re not holding our breath.

IN CALIFORNIA, IT’S ALL ABOUT THE CLIMATE (MOSTLY)

By California Pete



When the going gets tough, the tough ... file lawsuits? A July 17 *San Francisco Chronicle* article by Kurtis Alexander reports that “Marin County, San Mateo County and Imperial Beach (San Diego County) filed separate but nearly identical lawsuits in their respec-

tive Superior Court offices that seek to tie fossil fuel development to climate-related problems in coastal areas. Lawyers for the three communities worked together to document such effects as more frequent flooding and beach erosion as well as the possibility that water will eventually inundate roads, airports, sewage treatment plants and other real estate.” Reminds me of the building of the Blue Route (I-476), which sent generations of lawyers’ kids to college as the Main Line gentry fought it for 30 years.

Let it burn

Speaking of smoke and other pollutants, an August 6th *New York Times* article by Justin Gillis reports on the efforts by some ecologists to convince authorities that fighting every forest fire is a bad idea, not only because of the direct costs in dollars and lives, but because doing so disrupts the natural cycle of forest renewal. Many plants cannot reproduce, and many creatures cannot live, until the land has been burned. The black-backed woodpecker, for example, is uniquely adapted to live in burnt-over forests. Just let the fires burn themselves out, and natural conditions will return, is the idea. But too many houses — usually belonging to well-off people — have been built among the trees, and owners demand protection for their property.

And when a forest that has not burned in a century does burn finally the huge load of fuel has accumulated causes the resulting fire to be much more destructive than it would otherwise be. Giant redwoods normally grow in park-like stands, with little undergrowth. For millennia lightning-sparked fire burned off that undergrowth every few years, while the redwoods, with their thick bark, were

undamaged. But now there is so much undergrowth that a fire can burn so hot that it kills the redwoods.

The answer would appear to be to go in and take out some of the underbrush and then burn off the rest, but try and do that: “We don’t have the money for that!” “It would cause air pollution!” “It would change the character of the forest,” (duh).

So it’s just muddle through, at least for now.

Not just any old pot for Berkeley

The People’s Republic of Berkeley has decided that the marijuana available all over the state is not worthy of the land of organic, free-range everything, and has passed an ordinance that all pot sold in the city must be tested and declared free of pesticides, solvents, mold, and mildew, according to a piece in the *Chronicle’s Green State* by Mat Melcon. Understandably, most pot and pot products don’t pass the tests. Given their filthy state, it’s no surprise that the state government is working on similar regulations.

Pot town, USA

Of course if you want to just toke yourself into oblivion, you could pay a visit to America’s first marijuana theme park, if plans for the town of Nipton go as promoters hope. “The entire town of 120 acres was purchased [August 3] by American Green Inc., a marijuana focused technology and growing firm based in Arizona,” according to *CNN*. “The reported price tag: about \$ 5 million.” The new owners plan to turn the town into the “first energy-independent, cannabis-friendly hospitality destination.” Groovy.

The black market will survive

Don’t think that legalization of pot will drive the traffickers out of business, says an August 6 *Chronicle* piece by Laurel Rosenhall. Remember that marijuana is California’s biggest cash crop, with an estimated production of about 13.5 million pounds (worth about \$23.3 billion at an estimated price of \$1765 per pound) per year, while the legal in-state market is currently about 2.5 million pounds (which is still 1250 tons). That leaves 11 million pounds per year for the black market.

Are you rich enough to live here?

To be able to buy a house in Philadelphia you need an annual income of \$31,507, according to a piece by Keith Gumbinger in *HSH.com*. That’s assuming a median home price of \$120,000 and a 4.29% 30-year mortgage. But what would you need in other places?

Nationally, the average home price is \$232,100, which would require a salary of \$52,969 to handle. But some places cost a lot more. To buy a home in Washington, for example, with a median price of \$383,500, you’d need a salary of \$82,545. And in San Francisco (“We’re number one! We’re number one!”), with a median home price of \$815,000, the needed annual income is \$161,110. Don’t everybody jump at once.

SEPTEMBER MEETING

The September meeting will be held in conjunction with National Drive Electric Week. It will be at

Mt Holly Motorsports
2044 Rt 206
Vincentown, NJ 08088
11am-3pm

For more information, go to <https://driveelectricweek.org/event.php?eventid=936>

Last year we had 24 EVs there.

NOTICE ON DUES

Annual dues are \$20 with electronic delivery of the Newsletter, or \$25 for a printed copy. Make checks payable to EEVC and mail to James Natale, 3307 Concord Dr, Cinnaminson NJ, 08077, or pay via PayPal to www.paypal.me/EEVC.

MEETING SCHEDULE

Meetings are held in Room 49, Plymouth-Whitmarsh High School, 201 East Germantown Pike in Plymouth Meeting, PA, and begin at 7:00 p.m.

September 13
Vincentown, NJ

October 11

November 8

December 13