

Electric Auto Association

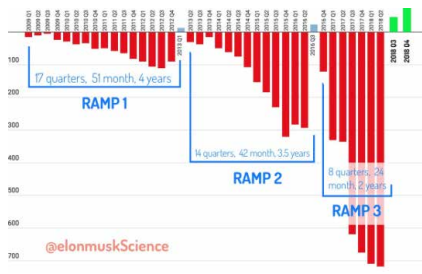


CURRENTEVENTS

January 2019 Promoting the use of electric vehicles since 1967 Vol. 51 No. 1



BYTON Provides Look At M-Byte Electric SUV Production Model At CES. See Page 6



**Tesla Shortens Vehicle
Ramp Cycles**
... page 13



**A Short EV History
Perspective**
... pages 17



**Porsche's EV-
Taycan**
... pages 29-32

Articles

- 1 BYTON EDMUNDS 2019 CES TECH DRIVEN AWARD!
- 3 GREETINGS MEMBERS AND EV ENTHUSIASTS!
- 4 THANK YOU TO OUR SUPPORTING MEMBERS
- 4 2018 BROUGHT THE ELECTRIC CAR TO EVERYONE
- 5 DO YOU SHOP AT AMAZON?
- 6 BYTON FOUNDERS EXUDE CONFIDENCE AT CES — Securing a coveted production license in China
- 8 SEE INSIDE THE PRODUCTION VERSION OF THE BYTON ELECTRIC SUV
- 10 REPORT: HOME ELECTRIC-CAR CHARGERS VULNERABLE TO HACKERS
- 12 TESLA Q4 2018 VEHICLE PRODUCTION & DELIVERIES, ALSO ANNOUNCING \$2,000 PRICE REDUCTION IN US — Tesla statistics
- 13 TESLA VEHICLE RAMP CYCLES GETTING SHORTER (CHARTS) — Charts illustrate Tesla progress at different time frames
- 17 A BRIEF HISTORY OF ELECTRIC VEHICLES
- 20 EMOTORWERKS LAYS GROUNDWORK FOR VEHICLE-TO-GRID CHARGING — A new business agreement between home charger manufacturer eMotorWerks and utility software provider LO3 energy
- 21 EMOTORWERKS AND LO3 ENERGY INTRODUCE PLATFORM TO CONNECT EV OWNERS WITH MICROGRIDS — Another take on the connection between the two companies
- 22 FASTCHARGE PROTOTYPE STATION SHOWS THREE-MINUTE TIME FEAT — How easily, how conveniently, how fast, will I be able to charge my electric car?
- 24 GM EV STRATEGY LAST CHANCE FOR CADILLAC'S SUCCESS: EXECUTIVE — The automaker's final opportunity
- 25 UP CLOSE WITH RIVIAN'S R1T ELECTRIC ADVENTURE TRUCK — Following up from December issue of *Current Events*
- 26 SCIENTISTS LOCATE NEARLY ALL U.S. SOLAR PANELS, EXAMINE WHO GOES SOLAR AND WHY — Stanford Research
- 28 NEW RED TESLA SEMI ELECTRIC TRUCK PROTOTYPE SPOTTED IN THE WILD
- 29 PORSCHE TAYCAN IS ALREADY ATTRACTING STRONG INTEREST FROM TESLA OWNERS — A possible competitor
- 30 PORSCHE TAYCAN FACTORY WILL HELP CLEAN THE AIR
- 31 PORSCHE PLANS TO PRODUCE AN IMPRESSIVE 40,000 ALL-ELECTRIC TAYCAN CARS PER YEAR — Doubling the planned production capacity for the Taycan
- 32 WHY THIS NEW ELECTRIC PORSCHE WILL BE THE HOTTEST CAR OF 2019
- 33 LOTUS' FIRST ELECTRIC CAR MIGHT BE A 1,000 HP MONSTER — \$2.5 million for the privilege, too
- 34 TESLA GIGAFACTORY TOUR SHOWS WHERE TESLA CONTINUOUSLY DRIVES DOWN BATTERY COSTS — Lead of at least a couple of years over its theoretical rivals
- 35 TESLA GIGAFACTORY 1: NEW FLYOVER SHOWS NEW LOT AHEAD OF SCHEDULE — Progress is evident
- 37 NIKOLA MOVES CLOSER TO MARKETING HYDROGEN-ELECTRIC TRUCKS
- 41 NORWAY SEES BOOM IN EVS, FUELED BY THE GOVERNMENT — Will only sell zero-emissions cars by 2025

Columns

- 3 PRESIDENT'S COLUMN
- 36 EVENTS & CONFERENCES
- 38 NOTABLE VIDEOS
- 40 EAA MEMBERSHIP FORM
- 42 & 43 CHAPTER LISTINGS



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Current Events Back Issues

The EAA has put most of its issues from 2001 to 2019 on its website.

Please visit

<http://electricauto.org/> and from the home page, click on "Documents" in the top navigation bar.

The resulting page has a listing of years (in a folder), which, when selected, will list the issues for each month. In that folder you will be able to download the PDF that contains the issue you choose.

Greetings Members and EV Enthusiasts!

As we enter this New Year, we anticipate an EV sales increase. Electric Auto is pleased to announce a new program to enrich the strength of our consumer engagement by EV owners. We are going to call it **EV Educate**.

EV Educate will empower, educate and equip our members.

Some EV owners are happy to just to turn up with their EVs in display, engaging consumers by telling their own stories of driving electric. This engagement is essential to making the world of electric vehicles real for our neighbors, friends, colleagues, and others in our communities. These conversations are powerful.

For EV owners who would like to take their consumer engagement to the next level, there is: **EV Educate**.

A central piece of the program is the *Certification of EV Owner/Educators*. This simple training program validates the knowledge areas of EV incentives, tax credits, charging, local perks, including HOV lane use as well as teaching best practices for consumer engagement, including dispelling the abundant myths surrounding electric cars.

So many of our EV “Owner/Educators” are already subject matter experts in the world of EV adoption. Now, that knowledge can be validated. We would love you newcomers to join in! You can learn and quickly apply that knowledge at events and presentations, and even become eligible for pay, where available.

How to become certified? It’s easy — webinars and videos, role-play, quizzes, certify!

Benefits of EV Educator Certification:

Training and certification for chapter members and volunteers will help us all communicate information accurately, completely, and consistently. In working with the team at events, those who are certified can be the “go to” people for tougher questions posed by the consumers. “EV Educators” will also benefit from becoming better communicators, not only personally, but in their ability to be part of the solution to help the “EV Curious” to understand this newer technology of driving electric. Certified EV Owner/Educators may also be eligible to receive pay for event work, where available.



Raejean Fellows

In summary, with more EV educators, some of whom are certified, we can handle more events, educate more consumers . . . accelerate EV adoption — Our Mission.

To learn more:

Sign on to the Interest Group “EV Educate Certify!” on the <http://www.ElectricAuto.org> website for updates on the **EV Educate Certification Program**. (Login, Member Profile, Website, Interests, select EV Educate Certify!).



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2018 Brought the Electric Car to Everyone

The Model 3 might still be pricey but there are alternatives.



By Roberto Baldwin

It's easy to look at a luxury automaker like Jaguar and declare 2018 the year the automotive industry caught up with Tesla. But like the Model X and Model S, the I-Pace is out of reach for most folks. It's great that people with large bank accounts can get behind the wheel of a vehicle that runs on electrons instead of dead dinosaurs. What's better is that 2018 showed that the rest of us can do the same thing.

The result: On the horizon, there's a wave of electric vehicles truly built for everyone -- and that's where real change comes from.

Maybe you won't buy one now, but you'll have the real-world experience of electric torque. That knowledge will be there when other cars that you can afford come on to the market. Oh, and there are way more cars coming on to the market.

[These paragraphs are excerpts from Roberto's article where he looks backward from rear view mirror of 2018 to what's ahead in 2019. Read his article at the ULR across the bottom of the page.]

"It's no longer a party for the rich. We can bring hot dogs and burgers to this shindig"

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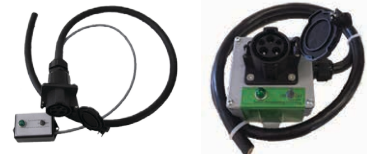
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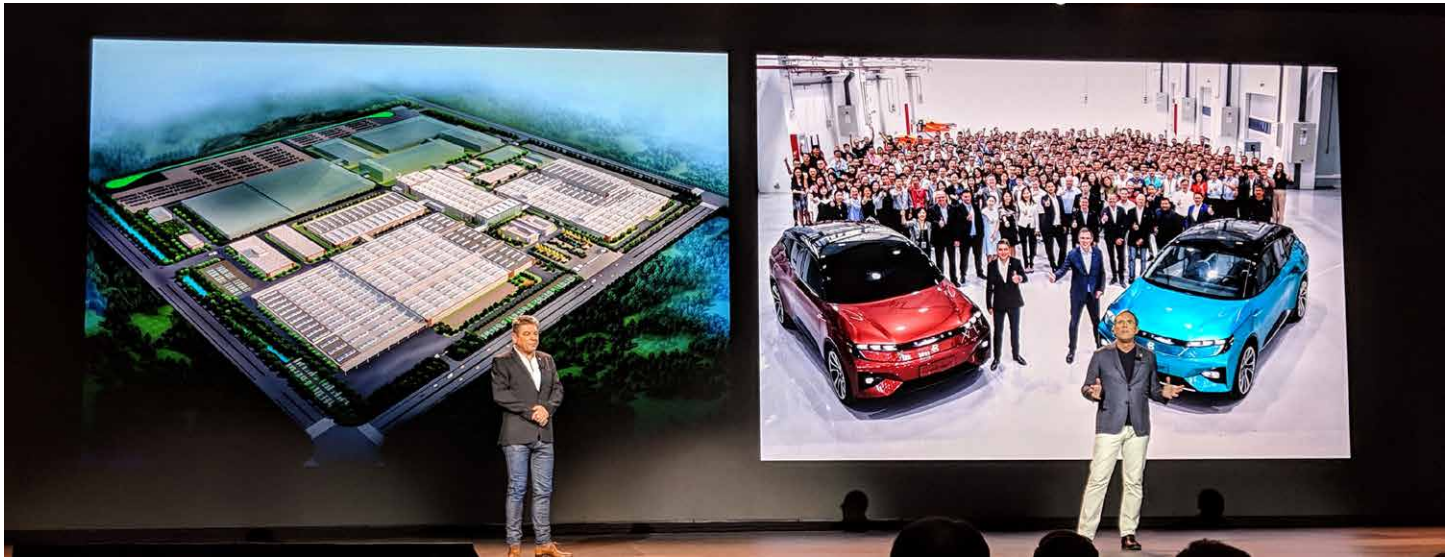
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- Use as EVSE cord or J1772 Extension
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BYTON Founders Exude Confidence at CES

Founders: We're not going away



By Tom Moloughney

BYTON's founders Carsten Breitfeld and Daniel Kirchert certainly didn't mince words during their presentation at CES 2019 in Mandalay Bay's Convention center this past Sunday night. In front of about a packed room holding about 800 members of the media, VIPs and other industry guests. The message was clear: "BYTON has arrived."

That might be a strong statement for a car company that hasn't yet delivered a single car to a retail customer, but considering that the company is only about three years old, and their global introduction was exactly one year ago at CES 2018, they actually have accomplished a lot. One of the things Kirchert mentioned is that BYTON is close to securing a highly-coveted production license in China.

"BYTON is well on track to secure a production license in China. If you're going to build a standalone, fully independent car company from scratch, you also need to control your R&D, design manufacturing and assembly. With this license, we'll be able to control our own destiny"

— Daniel Kirchert- Founder



BYTON's founders Breitfeld and Kirchert talk about the progress of their manufacturing plant in Nanjing.

continued next page



BYTON's Santa Clara, California headquarters.

Their manufacturing plant which only broke ground in September 2017, is now progressing at an amazing speed, and is on schedule for completion later this year; on time as promised. BYTON said the factory was actually ready to begin making M-Bytes for testing as of August 2018, and about 100 of the vehicles have already been built there. Some of which were used to crash testing, and BYTON has claimed the M-BYTE has passed all global crash testing standards.

BYTON also released pictures of the production interior of the first vehicle they will bring to market, the M-Byte SUV. The base M-Byte will cost \$45,000 and come standard with a 71 kWh battery. An optional 95 kWh battery will also be available. Range is estimated to be 250 miles and 325 miles, respectively. The full reveal of the production version of the M-Byte will be revealed sometime in the first-half of 2019, with start of production beginning a few months later, in Q4 of 2019. Those initial vehicles will be destined for Chinese customers, with US-deliveries beginning about 9 months later in Q3 2020.

"I'm very happy to announce that we're making great progress and staying on track as we move towards the start of production of the BYTON M-Byte at the end of this year"

– Carsten Breitfeld, Founder and CEO



BYTON Founders Breitfeld and Kirchert discuss the grand opening of the first "BYTON Place" brand store in Shanghai, China

Breitfeld also noted that BYTON is especially proud of their partners, including First Auto Works (FAW), CATL, Bosch and Amazon:

"Collectively, these great companies and many more have chosen to support the BYTON vision through collaboration and co-development. This network of partners really recognizes BYTON's potential. They want to grow with us, they want to work together, and together we want to reinvent the car and mobility. And for that, we are really grateful."

Breitfeld also said the Nanjing factory will begin start of production on time at the end of the year and the factory will be capable of producing up to 300,000 vehicles per year. He then announced

that on January 17th the first BYTON brand store or "BYTON Place" in Shanghai, China. A very good sign that things are indeed moving along on track and on schedule.

We know there's still some skeptics out there and for good reason. There have been many startup electric car manufacturers that have talked a good game, but were never able to really put up and deliver when they said they would. We believe BYTON is different, and as time goes on, they keep hitting their marks. Now management is now sounding less like a hopeful startup, and more like a confident, experienced player. 2019 is going to be an interesting year for BYTON, and we'll be there to report on whether they slip up, or continue to deliver.

continued on page 8

<https://insideevs.com/byton-founders-exhude-confidence-at-ces/>

See Inside the Production Version of the Byton Electric SUV

By Tom Moloughney

If BYTON is able to adhere to their previously announced timelines, they are less than a year from the start of production for the all-electric M-Byte SUV, the first vehicle to come from the new automaker. With that in mind, we expect 2019 to be chock full of announcements and reveals, since the M-Byte vehicles BYTON paraded around the world in 2018 were in concept form

So it's no surprise to us that BYTON decided to show off some pictures of the production-intent interior of the upcoming SUV. What may surprise some of our readers, is that BYTON is sticking with the large display screen, that pretty much stretches the entire length of the dashboard. BYTON representatives had assured us from the start that was their intention, but there were those that doubted whether or not that would find its way into a production vehicle.

So it's no surprise to us that BYTON decided to show off some pictures of the production-intent interior of the upcoming SUV. What may surprise some of our readers, is that BYTON is sticking with the large display screen, that pretty much stretches the entire length of the dashboard. BYTON representatives had assured us from the start that was their intention, but there were those that doubted whether or not that would find its way into a production vehicle.

The M-Byte SUV, as well as the K-Byte sedan, (arriving about two years after the M-Byte) is available in 71 kWh and 95 kWh battery configurations. The smaller battery will offer approximately 250 miles of range, and with the larger



BYTON Provides Look At M-Byte Electric SUV Production Model At CES



BYTON's M-Byte SUV production interior

battery, range is estimated to be 325 miles. BYTON hasn't commented on which range measuring standard they are using, but we believe it's most likely the WLTP, so EPA range figures would likely be slightly less.

BYTON also showed off their UI/UX technology at CES, and is one of the aspects of the vehicle that their team seems most proud of. There are multiple ways to interact with the M-Byte, including gesture and voice control as well as physical buttons.

We'll be sitting down with the BYTON management team here at CES in the few days, and will bring you more insight into the company's plans for 2019.

BYTON's full Press Release: January 6, 2019

BYTON, the premium intelligent electric vehicle brand, today revealed new details about its first production model, the M-Byte SUV, at the Consumer Electronics Show (CES)

continued next page

2019 in Las Vegas. Positioned as the next generation smart device, BYTON is designed for the future of autonomous driving when the automobile will become a mobile digital lounge.

“BYTON’s M-Byte represents the transformation of the traditional car into a next-generation smart device for every user,” said Dr. Carsten Breitfeld, CEO and Co-founder of BYTON. “We achieve this through the combination of our state-of-the-art EV platform and our proprietary BYTON Life digital ecosystem.”

A Digital Cockpit That Improves The Driver Experience

BYTON’s Shared Experience Display (SED) remains the world’s largest in-car display for a production automobile. It displays vehicle and driving information and offers various content options in an intuitive way. The position of the display has been carefully developed and tested to not affect driver line-of-sight and can automatically adjust brightness according to changes in ambient lighting to avoid further distraction. In addition, the SED will meet automotive safety standards as well as crash standards in all target markets.

The production M-Byte’s user-interface and user experience (UI/UX) hardware will feature abundant shared and private screen space to capture and display a wide array of digital content – music, videos, photos, files, contacts, and more – intuitively and safely to users in any seat:

- The 7-inch Driver Tablet pioneered by BYTON will be at the center of the steering wheel just above the driver airbag, serving as one of the main interfaces for the driver to

configure the vehicle and interact with the SED.

- An 8-inch BYTON Touch Pad has been added between the driver and the front passenger seats on the production model, enabling the front passenger to control the SED and enjoy the same interactive experience as the driver.
- Rear passengers have access to independent rear-seat entertainment screens that also share content with the SED.
- The front seats can be rotated inward 12 degrees, to create a space that is more convenient for passengers in the car to interact and communicate with each other when not in motion.
- The dashboard features a new wraparound design with air conditioning vents, gear selector, and other hard buttons located in the center along with a driver monitoring system to ensure safety during assisted-driving modes.
- Multiple interaction modes with the vehicle will be offered including voice control, touch control, physical buttons, and gesture control.

Enhanced User Experience & Personalized Mobility

BYTON users will have access to BYTON Life, an open digital ecosystem that connects applications, data, and smart devices. BYTON Life features advanced machine-learning capabilities that analyzes the user’s schedule, location, preferences, and application data to provide intuitive support such as scheduling reminders, online shopping tasks, remote charging management, and more. It can recognize voices of different users and sounds from different directions in the car. In North American and European markets, BYTON has been cooperating with Amazon Alexa to jointly develop

voice control. In addition, BYTON has also invited software developers from around the world to join BYTON’s ecosystem and explore new possibilities for applications and content on BYTON Life’s open platform.

Full-scale vehicle testing ahead of production

The production version of the BYTON M-Byte is slated to debut in mid-2019, with mass-production starting at the end of the year. To achieve this, vehicle testing continues in full swing to achieve the highest safety and quality standards of China, the US, and Europe. Meanwhile, BYTON’s Nanjing plant is on-track to be completed this year and will be equipped with cutting-edge production equipment from leading global partners such as AIDA Engineering of Japan, and KUKA and DÜRR of Germany. The company is also working with key strategic investors FAW and CATL, and world-class suppliers Bosch, BOE, and Faurecia to integrate the world’s best technologies and resources into its products.

“We have made solid progress in the construction of our Nanjing plant and prototype vehicle testing,” said Dr. Daniel Kirchert, President and Co-Founder of BYTON. “This is a vital year for BYTON and our global team is sparing no efforts to achieve our goal of volume production.”

About BYTON

It is not about refining cars. It is about refining life.

BYTON aspires to build premium intelligent electric vehicles for the future. Its crafted cars integrate advanced digital technologies to offer customers a smart, sage, comfortable and eco-friendly driving and mobility experience.

continued on page 10

Byton EV

continued from page 9

BYTON aims to create a premium brand rooted in China which has a global reach. Its global headquarters, intelligent manufacturing base and R&D center are located in Nanjing, China, while its North American headquarters, devoted to intelligent car experience, autonomous driving, whole vehicle integration and other cutting-

edge technologies, is based in the Silicon Valley. The company's vehicle concept and design center is located in Munich. BYTON also has offices in Beijing, Shanghai and Hong Kong to handle external affairs, marketing, sales, design and investor relations.

BYTON's core management team is made up of the world's top experts from China, Europe and the U.S., all of whom have held senior management

positions in innovative companies such as BMW, Tesla, Google and Apple. Their expertise covers automotive design, automotive engineering and manufacturing, electric powertrain, intelligent connectivity, autonomous driving, user interface and supply chain management among other industry sectors, the sum of which represents BYTON's strengths in manufacturing premium automobiles that are equipped with high quality internet technologies.



<https://insideevs.com/byton-unveils-mbyte-suv-production-model/>

Report: Home EV Chargers Vulnerable to Hackers

By Bengt Halvorson

Connected home chargers can bring a higher level of convenience to the electric-car ownership experience, allowing more flexibility with remote access, charge scheduling, power-output adjustment, and even data displays. But according to the cybersecurity company Kaspersky Lab, they can also bring a higher level of vulnerability to your home.

Kaspersky Lab reports that it recently discovered EV chargers from "a major vendor" with vulnerabilities that could be exploited by cyber-attackers.

The security experts note that a hacker could either remotely stop a charge on the unit, leaving the driver without adequate range, or set it to draw the maximum current possible, which they claim could potentially do damage to the home electrical system.

These smart chargers aren't alone in how they're connected; they're part of the vast of "Internet of Things" (IoT)—connected devices, like smart thermostats, smart refrigerators, and smart TVs, that go beyond their

original purpose by connecting and sharing data.

Beyond the potential damage to your home electrical system from this issue, the consequences include the same vulnerability of breaking into other IoT devices: the compromises of privacy and security.

While the company reports that the charger vendor patched the issue after being informed of it, we have to assume that not every vulnerability will be caught before it's exploited. These smart devices rely heavily on some cyber-security choices made by users—choices that aren't always made obvious to owners.

Here's Kaspersky's advice:

- 1) Regularly update all your smart devices, whether they're phones, tablets, TVs, or chargers.
- 2) Don't use the default password for routers—or any device—and don't use the same password for every device.
- 3) Isolate the "smart home network" from the network used by personal



ChargePoint home WiFi connected Charger devices, for internet searches or work tasks. You may want to contact your router maker, or a network expert, to assure you're doing walling those devices off correctly.

ChargePoint Home currently offers a wi-fi-enabled smart-charger through Audi's simplified installation program—via Amazon Home Services. It emphasizes that chargers need to be connected to a network both to take advantage of all the added features and to receive all the latest security updates. [More info at the URL below]



https://www.greencarreports.com/news/1120619_report-home-electric-car-chargers-vulnerable-to-hackers

EV Educational Resources

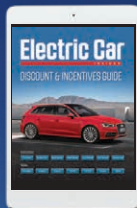
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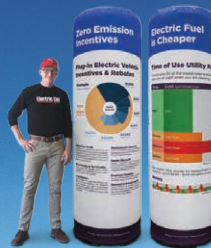
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Test drive the latest EVs and learn from EV owners



EV Navigator

Activity framework to guide prospective EV drivers on the path to EV ownership and advocacy

ECI creates educational resources to promote EV adoption from awareness to advocacy. Email or call us for a complete catalog of products and current pricing.

sales@electric-car-insider.com

619-337-4589

Tesla Q4 2018 Vehicle Production & Deliveries, Also Announcing \$2,000 Price Reduction in US

In Q4, we produced and delivered at the rate of nearly 1,000 vehicles per day, setting new company records for both production and deliveries.

Production in Q4 grew to 86,555 vehicles, 8% more than our prior all-time high in Q3. This included:

- 61,394 Model 3 vehicles, in line with our guidance and 15% more than Q3.
- 25,161 Model S and X vehicles, consistent with our long-term run rate of approximately 100,000 per year.

Q4 deliveries grew to 90,700 vehicles, which was 8% more than our prior all-time-high in Q3. This included 63,150 Model 3 (13% growth over Q3), 13,500 Model S, and 14,050 Model X vehicles.

In 2018, we delivered a total of 245,240 vehicles: 145,846 Model 3 and 99,394 Model S and X. To put our growth into perspective, we delivered almost as many vehicles in 2018 as we did in all prior years combined.

Our Q4 Model 3 deliveries were limited to mid- and higher-priced variants, cash/loan transactions, and North American customers only. More than three quarters of Model 3 orders in Q4 came from new customers, rather than reservation holders.

There remain significant opportunities to continue to grow Model 3 sales by expanding to international markets, introducing lower-priced variants and offering leasing. International deliveries in Europe and China will start in February 2019. Expansion of Model 3 sales to other markets, including with a right-hand drive variant, will occur later

in 2019.

1,010 Model 3 vehicles and 1,897 Model S and X vehicles were in transit to customers at the end of Q4, and will be delivered in early Q1 2019. Our inventory levels remain the smallest in the automotive industry, and we were able to reduce vehicles in transit to customers by significantly improving our logistics system in North America.

Moving beyond the success of Q4, we are taking steps to partially absorb the reduction of the federal EV tax credit (which, as of January 1st, dropped from \$7,500 to \$3,750). Starting today, we are reducing the price of Model S, Model X and Model 3 vehicles in the U.S. by \$2,000. Customers can apply to receive the \$3,750 federal tax credit for new deliveries starting on January 1, 2019, and may also be eligible for several state and local electric vehicle and utility incentives, which range up to \$4,000. Combined with the reduced costs of maintenance and of charging a Tesla versus paying for gas at the pump – which can result in up to \$100 per month or more in savings – this means our vehicles are even more affordable than similarly priced gasoline vehicles.

Tesla's achievements in 2018 likely represent the biggest single-year growth in the history of the automotive industry. We started the year with a delivery run rate of about 120,000 vehicles per year and ended it at more than 350,000 vehicles per year – an increase of almost 3X. As a result, we're starting to make a tangible impact on accelerating the world to sustainable energy. Additionally, 2018 was the first time in decades that an American car – the Model 3 – was the best-selling

premium vehicle in the U.S. for the full year, with U.S. sales of Model 3 roughly double those of the runner up.

We want to thank our customers, suppliers, investors, and especially our employees, who worked so hard to accomplish this.

Our net income and cash flow results will be announced along with the rest of our financial performance when we announce Q4 earnings. Our delivery count should be viewed as slightly conservative, as we only count a car as delivered if it is transferred to the customer and all paperwork is correct. Final numbers could vary by up to 0.5%. Tesla vehicle deliveries represent only one measure of the company's financial performance and should not be relied on as an indicator of quarterly financial results, which depend on a variety of factors, including the cost of sales, foreign exchange movements and mix of directly leased vehicles.

Forward-Looking Statements

Certain statements herein, including statements regarding growing the addressable market for Model 3, such as our plans and timing for international expansion, are “forward-looking statements” that are subject to risks and uncertainties. These forward-looking statements are based on management's current expectations. Various important factors could cause actual results to differ materially, including the risks identified in our SEC filings. Tesla disclaims any obligation to update this information.

TESLA

<http://ir.tesla.com/news-releases/news-release-details/tesla-q4-2018-vehicle-production-deliveries-also-announcing-2000>

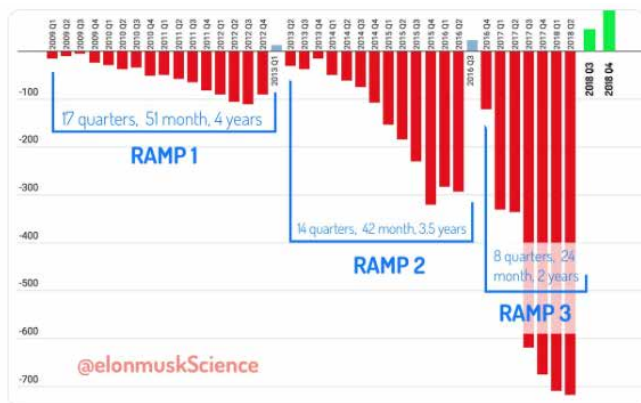
Tesla Vehicle Ramp Cycles Getting Shorter (Charts)

By Zachary Shahan

Twitter user @ElonMuskScience created an interesting chart last year based on Tesla financial data and shared it with us.

I thought it was fascinating and worth a long story, but we never got around to diving deeply into the topic (well, I mean, since Maarten did back in May). But the time has come. Here we go!

This was the original tweet:



EM SCIENCE ElonMuskScience @ElonMuskScience

Follow

/ @Tesla / Q3 2018

as predicted this month, the ramp up cycle is closed with a decent profit as it was in the last 2 cycles. Notably the ramp up cycles have shortened each time.

[\\$TSLA](#) [#TESLA](#) [@cleantechnica](#) [@Teslarati](#) [@ValueAnalyst1](#) [@InsideEVs](#) [@teslanomicsco](#) [@vijaygovindan17](#)

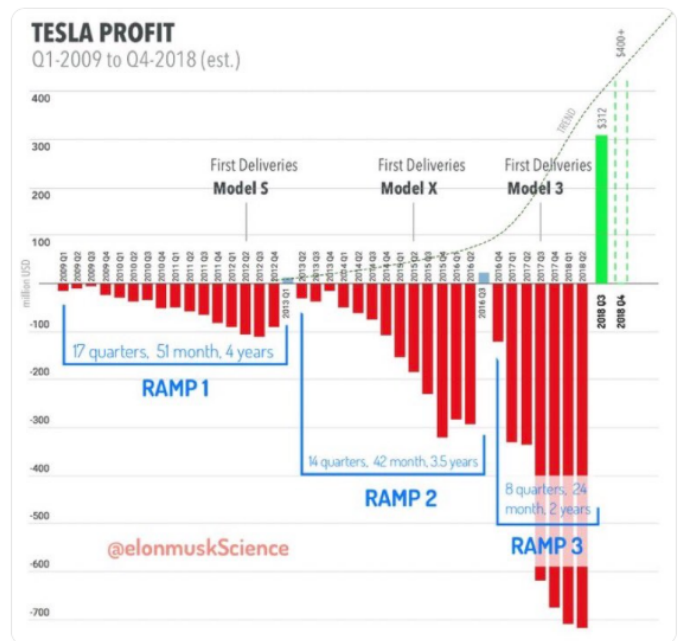
And a newer one appears at the top of the next column.

One basic point which all of the financial press seemed to ignore in 2018 is that it takes time to get a new product — especially something as complicated and costly as a car — through the production ramp and to profitability, but that doesn't mean the whole business model is financially unsustainable. It just means that it takes time to make money on a new product.

EM SCIENCE ElonMuskScience @ElonMuskScience

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Updated Tesla profit chart from Q1-2009 to Q4-2018 (est.). A exp. curve is forming. Tesla focus on efficiency gains leading to higher product profit margins. /W every profitable Q cash reserve grows & enough for future product ramps going forward. [\\$TSLA](#) [\\$TSLAQ](#) [#TESLA](#) [#EMScience](#)



Of course, professionals in the financial press have to know this — yet they continually ignored the point while covering Tesla and acting as though it could never make money and was essentially just a clever Ponzi scheme.

Just because Tesla was spending a lot of money on new products didn't mean those products wouldn't make the company a net profit eventually. That's what we tried to explain over and over in 2018 when so much of the media was forecasting Tesla's doom.

Anyhow, that's the basic point you can take away from the charts above, but there's a more interesting point highlighted by @ElonMuskScience here. That point is that the development cycle for Tesla vehicles — from initial development stages to actually making the company money

continued on page 14

Ramp Cycles

continued from page 13

— has been getting shorter and shorter.

“Ramp 1” in each of the charts represents the Tesla Model S’s path from its early stages of development to company profits. “Ramp 2” covers essentially the same cycle for the Tesla Model X, but that one comes in at 42 months instead of 51 months. (Note that both timeframes are quite short compared to normal vehicle development in the auto industry.)

The Tesla Model 3’s ramp — “Ramp 3” — showed a big reduction in the timeline, though, cutting the period down to just 24 months!

Tesla Vehicle Sales (Quarterly Deliveries)

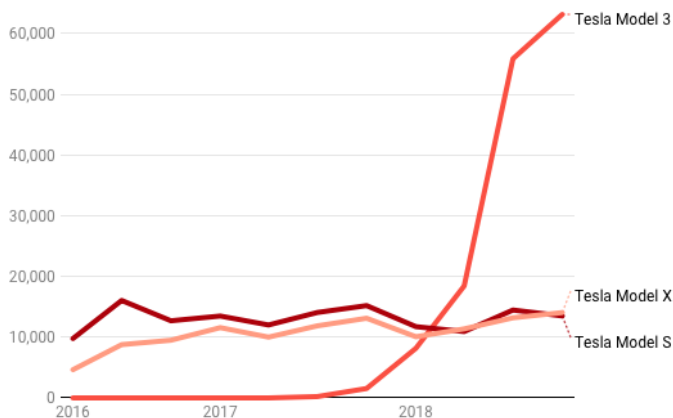


Chart: CleanTechnica • Source: [Tesla](#) / CleanTechnica • [Get the data](#) • Created with Datawrapper

Tesla Vehicle Sales (Quarterly Deliveries)

Toggle between the models (Model 3, Model S, and Model X) to see each model's quarterly delivery chart.

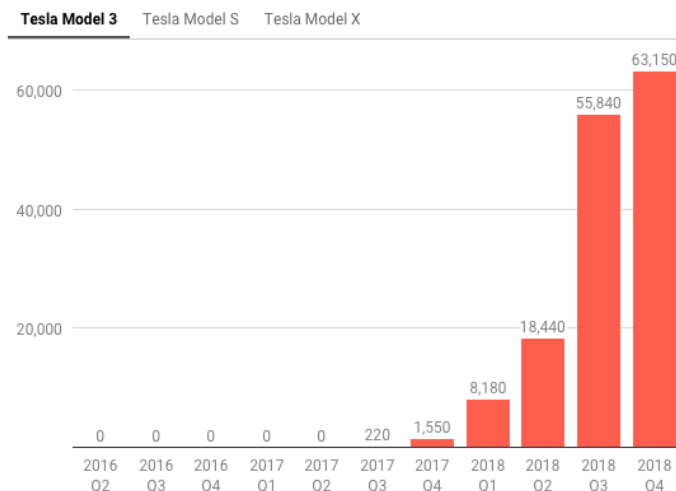


Chart: CleanTechnica • Source: [Tesla](#) / CleanTechnica • [Get the data](#) • Created with Datawrapper

As you can see in the second chart, it also led to soaring profits. (Selling 63,000 cars a quarter at an average selling price over \$50,000 = *a lot of revenue.*) See two charts in the previous column.

Small + Midsize Luxury Cars — Month to Month 2018 US Sales

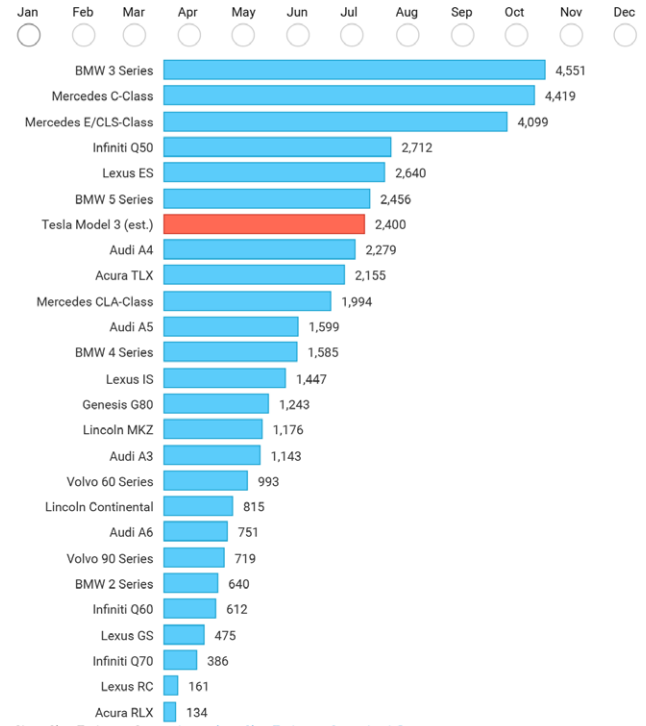


Chart: CleanTechnica • Source: [Automakers](#), [CleanTechnica](#) • Created with Datawrapper

Small + Midsize Luxury Cars — Month-to-Month 2018 US Sales

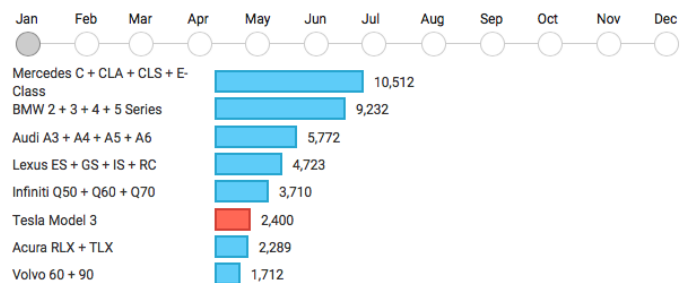


Chart: CleanTechnica • Source: [Automakers](#), [CleanTechnica](#) • Created with Datawrapper

Of course, there’s development of the models that goes on before the ramp timeframes shown. Nonetheless, it is clear that Tesla has gotten much quicker at completing the process between showing a prototype and making money (in net) on that model.

What about going forward? The Tesla Model Y is supposed to be shown in the middle of March. It is supposed to go into

continued next page

production in China in 2020. And perhaps earlier in the US? Will it be approximately 2 years from the time the Model Y is shown and it is delivering a cumulative net profit for Tesla? Will it be 18 months?

We don't actually have precise data to measure any this, as Tesla doesn't break out costs and revenue by model in such a way. Historically, @ElonMuskScience and others have basically tracked the results based on overall company costs & revenue — as you can see above — but we won't even have that method going forward, as Elon Musk expects the revenue from Tesla's Model 3, Model S, and Model X will be enough to fund new product development & production ramps while maintaining a company profit.

The whole thing is pretty amazing when you step back and look at it. Tens of thousands of Tesla employees made magic happen by somehow bringing product after product to market, selling these through new sales channels for the auto industry, rising from **a few hundred cars a quarter** to nearly **100,000 cars a quarter** in just ~6 years, and scaling up requisite manufacturing, service, supercharging, and sales networks all along the way.

You can see why so many in the auto world and financial world didn't expect Tesla to succeed. Making it through one humongous product ramp was a challenge, making it through another one was another challenge, and making it through a super rapid and high-volume third one was yet another daunting challenge. If any of those product ramps went too badly — in terms of production or consumer demand — Tesla would have crashed into a deep crater of debt.

But it didn't.

There were signs and historical precedence along the way to presume that Tesla would pull through. Nonetheless, Tesla had a seemingly unprecedented level of skepticism thrown its way, winning the title of most shorted company on the US stock market for much of 2018.

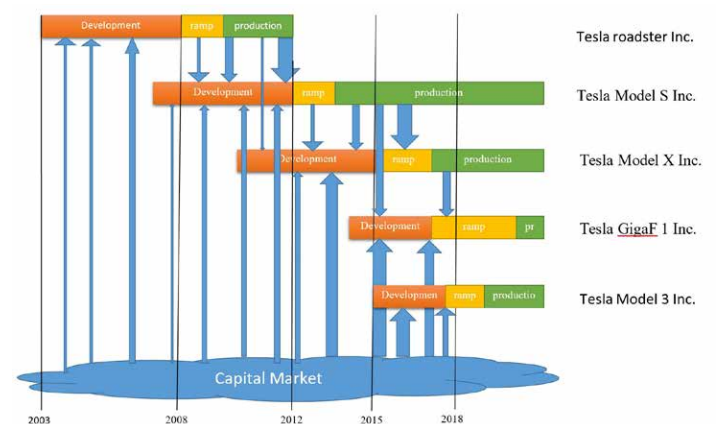
Now the company is employing 45,000 people and counting, and it appears to be in a very different period of its corporate life. There should be no more "bet the company" trials, as the real Elon Musk put it. The Model Y ramp, Tesla Semi ramp, and Tesla electric pickup truck ramp, while not walks in the park, should be easier to manage and fund thanks to lessons learned from the production ramps of the S-3-X model lineup. The revenue flowing into Tesla's piggy bank from those pillar products should help as well.

That said, stay tuned — there could always be life-threatening challenges around the corner, and Tesla short sellers accounting for billions of dollars of bets against the company will be sure to notify us of any forming (or imaginary) thorns and stumbles.

To wrap up, I'll return to comments Maarten made in 2018 in a handful of articles aiming to shed bright lights on Tesla's present and future when so many people were focused on the darkness:

Early May: "It was my impression that the original plan for the Model 3 was self-financing through a slow ramp and incremental building of the assembly line. The number of reservations changed those plans. Tesla accelerated the development of the car and design of the production and shortened the ramp by a whole year. ... I have a very strong impression that Tesla is only looking at self-financing for its future products and factories."

Middle of May: "The long answer is in 3 fresh articles here on CleanTechnica. This first one examined **the problems 450,000 Tesla Model 3 reservations created**. In this second one, we have a long look at the profitability of Tesla products. We finish with the media madness about 'Tesla Cash Burn.' ... But I think Tesla is secretly a potentially very profitable company. Or not so secretly, if you really pay attention to Tesla's finances. The only reason Tesla keeps reporting losses is because after launching each successful product, the next product is so much more ambitious that it can't be financed out of the revenue streams of the company's current products.



"To visualize this and make it easier to discuss, I have Tesla virtually split into separate companies, each providing a single product or service. Each company has its own financing, from sister companies or from the capital markets. Resources like design labs, research departments, specialized

continued on page 16

Ramp Cycles

continued from page 15

personnel, etc. are “sold” to sister companies for shares when no longer needed, mimicking the relationships between the parts of a consolidated company.”

Late May: “As usual, the rumors of Tesla’s demise are grossly exaggerated.”

Late May: “‘Tesla bankruptcy’ would perhaps be better termed ‘shorts losing their shirts.’ ...

“As usual, the rumors of Tesla’s demise are grossly exaggerated. If you haven’t been fooled in the past 10 years, don’t start falling for the rumors now.”

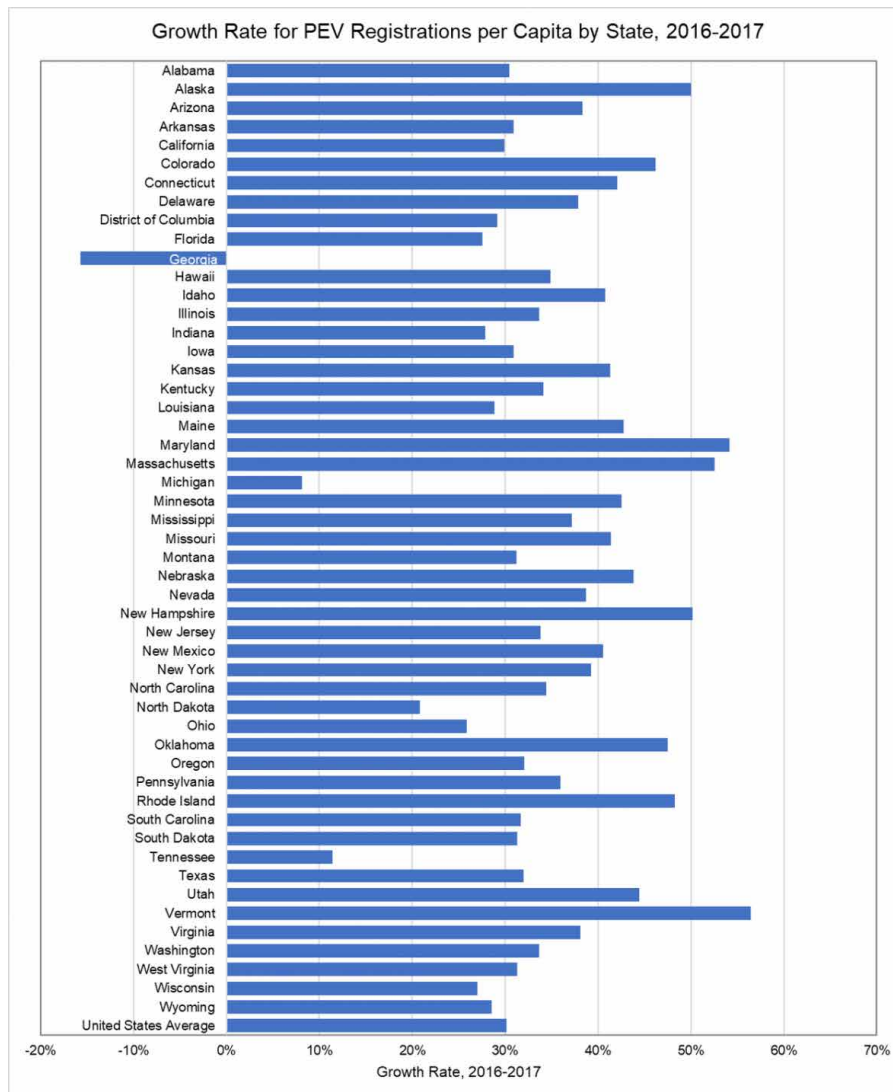
Indeed. Easier said now than in May of 2018. Kudos to Maarten for saying it then.

If you plan to buy a Tesla and want the benefits that come from using a referral code, feel free to use mine — <http://ts.la/tomasz7234> — or not.

—

<https://cleantechnica.com/2019/01/12/tesla-vehicle-ramp-cycles-getting-shorter-charts/>

Growth Rate of 56.4% for Plug-in Vehicle Registrations per Capita from 2016 to 2017



**Find
your
state!**

Note: PEV includes both all-electric vehicles and plug-in hybrid vehicles.

Sources: PEV registrations – Department of Energy analysis of IHS Automotive data.

Population: U.S. Census Bureau, Population Estimates, Annual Estimates of the Resident Population.

<https://www.energy.gov/eere/vehicles/articles/fotw-1061-december-24-2018-vermont-had-growth-rate-564-plug-vehicle>

A Brief History of Electric Vehicles

By Bill Palmer, Co-Founder, EAA

In 1835 Thomas Davenport, a blacksmith in Brandon, Vermont, started electric transportation by inventing the electric motor and applying it to driving a small train in his yard. His electricity source was copper and zinc plates in a sulfate solution. Others built one-of-a-kind electric cars and locomotives soon afterward.

A bit later, in 1860 Gaston Plante invented the lead-acid battery in France. Then individual electric cars were built by Fred Kimball and Thomas Edison and, in 1892, William Morrison started commercial production of electric cars. In 1897 Pope, Columbia and Electric Vehicle Co. built 2000 electric taxis.

Speed soon became the objective. The first record was set in 1898 by Jeantand at 39 mph. near Paris. In 1899 Camille Jenatzy raised it to 68.8 mph. In 1905 Walter Baker drove his "Torpedo" 120 mph. Interest in speed lagged until 1972 when the Eagle Pitcher Co. wanted to publicize the silver-zinc batteries it was making for the space program. They built a race car using their batteries and a motor they rented from several of us EAA members and they set a new speed record of 146 mph. at Bonneville. Two years later, in 1974, Roger Hedlund raised the speed record for electric vehicles to 175 mph. That record held for 21 years until a General Motors EV-1 did 183 mph. in 1995. Then, in September of 1996 Ed Rannberg and Lloyd Healy each exceeded 200 mph. one-way at Bonneville Salt Flats. Their two-way averages were 196.199 and 198.487 mph. respectively.

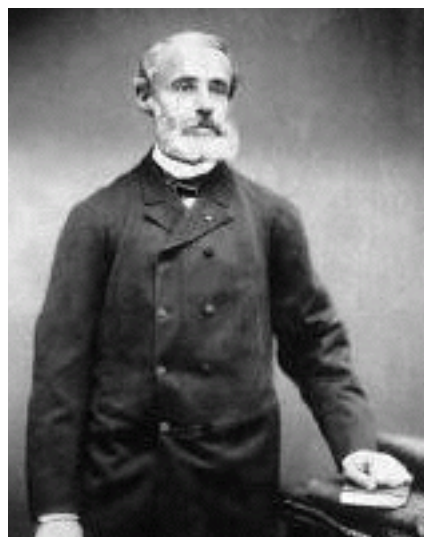
One of the most significant demonstrations in the early days of electric cars was done in 1908 by Oliver Fritchle, who made electric cars and batteries in Denver. He challenged all other electric car makers to a cross-country race to New York City. No-one accepted his challenge, so he decided to do it alone. He discovered that there were not enough places to charge batteries between Denver and Lincoln, Nebraska, so he started his cross-country drive from Lincoln. He drove 1800 miles from Lincoln to New York, in 20 days, averaging 90 miles per day. He used creative methods of charging batteries such as throwing a wire over trolley power lines with a water box in series to regulate charging current.

The high point for electric vehicles was about 1912. Twenty companies were building electric cars commercially. 30,000

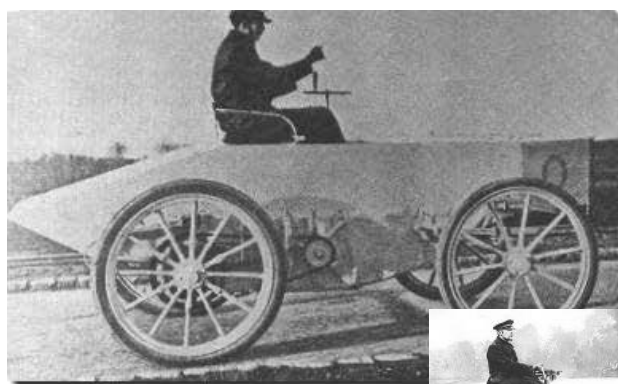
continued on page 18



Thomas Parker Electric car 1895



Gaston Plante



1899: Camille Jenatzy and Count Gaston de Chasseloup-Laubat trade speed records



EV History

continued from page 17

were registered. The Detroit Electric Car Company made about half of them. Some other makers were The American Bicycle Co. which made the Waverly Electric Car, Babcock Electric Carriage Co., Baker Motor Vehicle Co., Columbus Buggy Co., Electric Vehicle Co., Milburn Wagon Co., Ohio Electric Car Co., Rauch & Lang Carriage Co., Riker Motor Vehicle Co., and Woods Motor Vehicle Co.

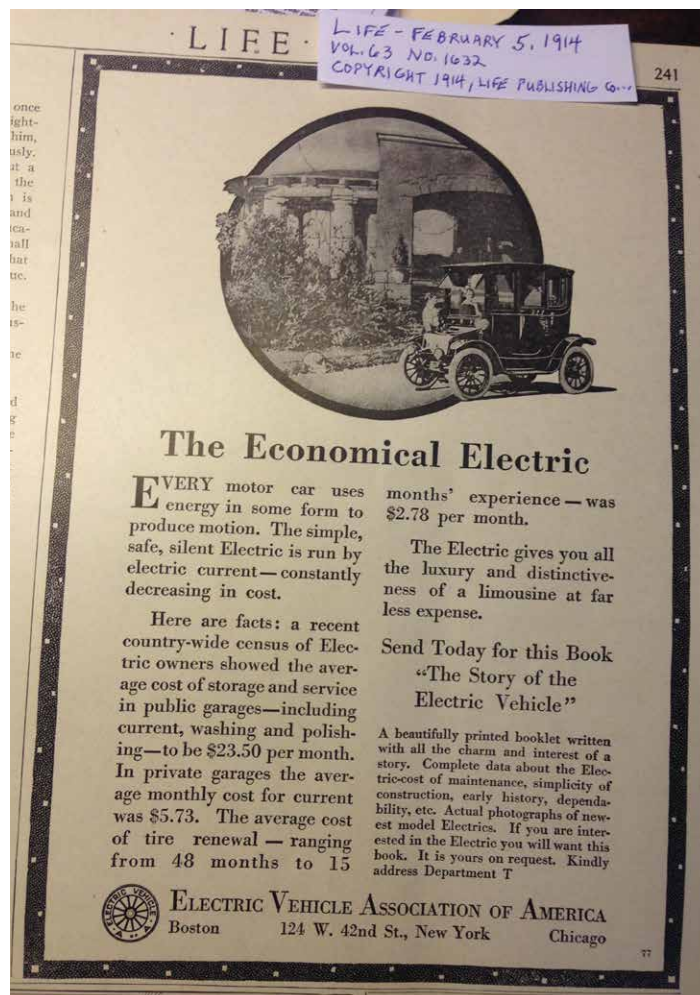
Women preferred electric cars because they didn't have to hand-crank them to start the engines. That changed in 1911 when Charles Kettering invented the self starter motor for gasoline engines. Then, as now, gasoline cars were preferred because they would go farther and faster. From 1912 electric car manufacturing declined until it ceased entirely in 1939 when Detroit Electric Car Co. ceased production.

There was little interest in electric cars from 1939 to about 1958 when the Stinson Aircraft Co. tried to revive interest by converting some VW Karmann Ghia's to electric power and called them Charles Townabouts. Their engineering was not adequate and a few of them seen disabled on the side of the road sealed their fate. Then, in 1960 The Eureka Vacuum Cleaner Co. offered converted Renault Dauphines calling them Henny Kilowatts. They weren't popular either.

In 1967 The Santa Clara Valley Engineers' Council, eight national engineering societies and the San Jose State College School of Engineering conducted a two-day "National Electric Automobile Symposium." 22 presentations were made by government agencies, electric utilities, vehicle and component manufacturers, including Ford and General Motors. At the end of the symposium Walter Laski asked the attendees whether anyone would be interested in forming an association to continue promoting development and use of electric vehicles. About six of us expressed interest and we formed The Electric Auto Association which has been meeting monthly ever since and now has several thousand members and 40 chapters in the U.S. and Canada.

In response to the oil shortage in 1973 the Federal government made money available for developing transportation technologies not based on petroleum. GE and Chrysler made the Centennial electric car in 1975, GE's centennial year. Apparently no effort was made to make it a commercial product. Then in 1979, GE and Chrysler made a more conventional electric car, the ETV-1. It was not commercialized either. Unique Mobility, in Denver, built

continued next page



Life Publishing 1914



1973-1977: The Enfield 8000

and sold about 50 Electreks which had a fiberglass body with a battery tunnel in the center, a GE motor and a SCR controller. Jet Industries, in Dallas, Texas added electric propulsion to Ford Escort sedans and Subaru minivan gliders and sold about a thousand of them.

In the mid-1990s the California Energy Commission made grant money available for hybrid EV development. A few members of the Silicon Valley chapter of EAA formed a team, headed by Dr. John Reuyl. We applied for, and received, a grant of \$180,000 which was to be matched by contributed labor. We acquired a Chevrolet Corsica and converted it to series hybrid propulsion using a small, English rotary engine developed for powering small drone aircraft and a Prestolite truck alternator rated at 280 Amperes and 28 Volts. We operated it at 140 Volts to charge the 120 Volt battery. We achieved static operation using two bench-mounted computers with engine emissions in the super low level. The money ran out before we could do road testing.

I think that more progress in EV technology has been made in the last ten years than in the prior 100 years. The most significant development is hybrid EVs with computerized control of power splitting between the engine and motor and regulating battery charging. When plug-in capability and more battery are added enabling local driving in the EV mode, with the engine off, we have the ideal vehicle. It has the unlimited range of liquid-fueled cars and, in the EV mode, the high efficiency, clean, quiet operation and reduction of use of foreign fuel of battery electric cars without the high battery cost of long-range battery EVs. I am anxious to convert my Toyota Highlander Hybrid to plug-in.

[Ed. This article was originally created in the spring of 2007 by Bill Palmer, one of the original founders of our organization. He looks back ten years; yet today we can look back again at the most recent decade of progress and marvel at what EV buyers now have available: an ever growing variety of OEM products to choose from.

We feel it is important to keep the long EV development history in mind. Just as the EAA and CalCar.org brought the modern plug-in hybrid to the attention of the automakers about 14 years ago, with a resulting birth of the Chevy Volt. That announcement prompted Bill to want to convert his Toyota Highlander to a plug-in. The progress we have seen continues to amaze and delight.



1977_American_Motors_Electron_Concept_02



1996: The first 660 EV1s produced are built with GM lead-acid batteries

The rate of change is becoming brisk. Witness the previous article on Tesla's product ramp cycles. As a growing major player, streamlining their efforts, other vendors are joining the race. Some brand new entries are beginning to get a foothold. Rivian was covered last month, with an update here on page 25 and video on page 38. Electrification of transportation is happening after a long road of experiments.]



Additional photos and information about EV History is at the following URL
<https://cleantechnica.com/2015/04/26/electric-car-history/>

eMotorWerks Lays Groundwork for Vehicle-to-Grid Charging

By Eric C. Evarts

At first glance, a new business agreement between home charger manufacturer eMotorWerks and utility software provider LO3 Energy sounds strictly like the stuff of dull business contract lawyers.

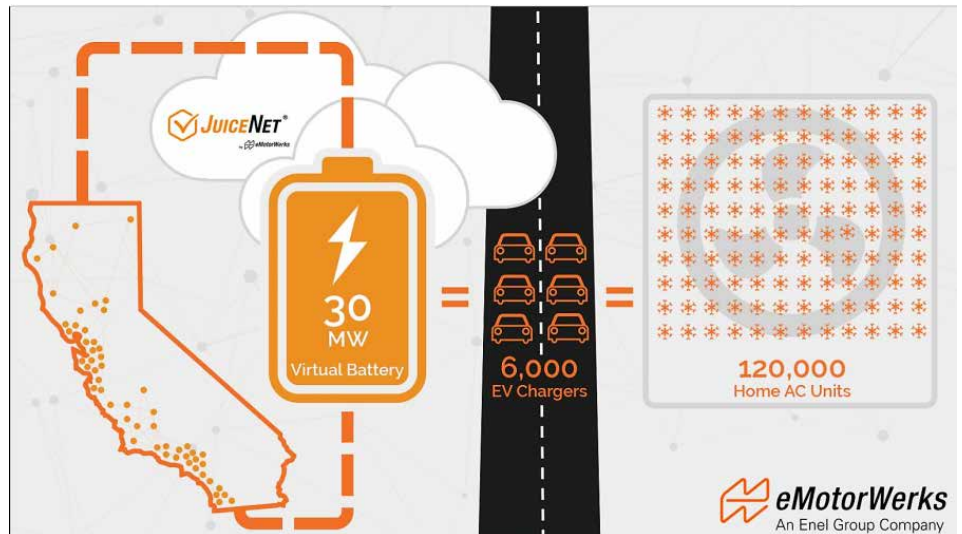
Dig a little deeper, though, and it could be the kernel of the next generation electrical system, long discussed, but never-quite-practical vehicle-to-grid infrastructure.

As many electric-car drivers know, eMotorWerks builds networked JuiceBox home chargers, some faster than most others, that allow users to program them via the internet to start and stop charging as energy rates fluctuate. The boxes access live rate information as they let drivers program when they need a full charge in their car, so the car will be fully charged, at the lowest possible cost, before they need to go. (Users can also do simpler things, like check on the car's state of charge and set it to start and stop remotely, from a cell-phone app.)

LO3 Energy provides a blockchain-software platform that allows consumers to trade electricity on a local grid, setting prices and managing supply and demand locally.

The eMotorWerks JuiceNet platform enables control over local energy flows, while LO3's software enables energy trading on local networks at set prices.

The tie-up between the companies, announced last month, aims to demonstrate that not only can JuiceBox users get the lowest available rates, they can also ensure that they get



eMotorWerks 30-megawatt virtual energy storage battery for California Energy (Graphic: eMotorWerks)

power supplied to their plug-in cars from appropriately renewable sources.

In their latest agreement, the companies plan to select an LO3 microgrid site, such as one the company operates in Brooklyn, New York, to demonstrate the program. (It could select a different LO3 microgrid.) The pilot project is expected to show how spreading charge times across multiple cars can reduce peak demand on the grid while still charging all the cars that need to get charged.

The companies point to an eMotorWerks demonstration project announced in September in California as an example. It uses 10,000 electric-car chargers to balance up to 30 megawatts of renewable power in the state, to reduce on-peak demand for non-renewable power—the equivalent of 120,000 home air conditioners.

So far, challenges winning support from automakers, over concerns with battery

cycling and warranties, as well as cost of cars and chargers, have stymied full V2G interactions, where power can flow both directions, from the grid to the car and from the car to the grid.

Preston Roper, general manager of e-mobility for Enel X in North America, which now owns eMotorWerks, says the two-way communications behind V2G can achieve most of the benefits of V2G with power flowing only from the grid to cars, by managing the charge load and timing among different cars.

“You pretty much get half the value of V2G with V1G. but we can use all the services,” he says, referring to unidirectional vehicle-grid integration. “From the grid perspective, it’s the same.”

Such vehicle-grid integration can, for example, help utilities to avoid large spikes in local demand that can blow up transformers, for example, thus saving costs. And for businesses with several

continued next page

chargers, or hosts of Tesla supercharging sites, for example, can minimize expensive demand charges that utilities sometimes charge during peak usage.

By allowing the electric-car drivers to set prices at which they are willing to pay to charge, the system lays the foundation for vehicle-to-grid concepts while ensuring that the car gets charged sufficiently to get them to their destinations.

Roper uses his own electric car as an example. He says he commutes only about 40 miles a day, which takes only a little over an hour to charge

every night. By using eMotorWerks' predictive software, the car charger can choose the hour during the night to charge when renewable generation is highest or rates are lowest.

V2G, as it has become known, envisions the large battery packs in millions of electric cars on the road as storage buffers for renewable energy, such as wind that is produced off-peak at night, to use under peak loads during the day. With the average vehicle parked for 92 percent of its life, according to studies, electric cars, plugged into the grid, could alleviate the need for billions of dollars of dedicated battery storage for

renewable energy installations.

Make no mistake, this tie-up doesn't enable V2G on its own. Other factors, such as connectors, building codes, and battery warranty questions would have to be addressed before electric cars could be depended on to feed power back to the power grid.

Still, the ability for electric-car drivers to specify and receive one source of power over another, controlled in real time by the charging station, can provide proof of concept to fix one of the major concerns about wider use of V2G systems.



https://www.greencarreports.com/news/1120756_emotorwerks-lays-groundwork-for-vehicle-to-grid-charging/

eMotorWerks and LO3 Energy Introduce Platform to Connect EV Owners with Microgrids

By Charles Morris

EVSE manufacturer eMotorWerks has partnered with LO3 Energy to explore the idea of combining energy demand from EV charging with a local microgrid powered by green energy.

An initial project will connect eMotorWerks' JuiceNet EV charging platform to one of LO3's transactive energy marketplaces, allowing local renewable energy to be traded between EV owners and the microgrid. LO3's Exergy platform underpins the data exchange that enables price signals and peer-to-peer transactions, while eMotorWerks' JuiceNet enables control over local energy flows, matching the local demand from EVs and households with the local supply of green energy in real time.

"Beyond offering a way for residents to

manage charging more efficiently, this partnership with LO3 showcases how powerful smart charging can be for grid services at scales ranging from hyper-local to state and national levels," said Vincent Schachter, Senior VP of eMotorWerks.

The project is a component of a broader service portfolio designed to enable utilities to better decide when and what type of resources are used to charge EVs, and when and how EVs can be leveraged as energy resources for local grid balancing through demand response.

"As utility business models adapt from evolving regulations and competition, new products and services supporting EVs allow utilities to amplify and reinvigorate their customer relationships," said Lawrence Orsini,



eMotorWerks JuiceBox Pro networked home EVSE electric-car charging station. (Photo: eMotorWerks)

CEO of LO3 Energy. "EV charging adds another option to efficiently match local energy supply and demand, and such projects' results could open the door to more transactions among other microgrid participants and EV drivers."



<https://chargedevs.com/newswire/emotorwerks-and-lo3-energy-introduce-platform-to-connect-ev-owners-with-microgrids/>

Fastcharge Prototype Station Shows Three-Minute Time Feat

By Nancy Cohen

How easily, how conveniently, how fast, will I be able to charge my electric car? Simple questions and car makers are quite busy giving us answers that will impress.

In fact, as a BMW blog stated, “The biggest hurdle automakers face with the adaptation to electric vehicles is not range but charge time...if it takes hours and hours to recharge the car, it’s still not as convenient as a normal ICE car. Which is why the race to create faster charging vehicles and charge stations is becoming more intense.”

[Ed: The author states truisms here. Convenient fast charge times are lacking. Conveniently located and quick charging times are rare today. The downsides are hidden in the details. Read the rest of our interjections to get a more realistic picture of what may well transpire in this area.]

“Car makers in Europe have been working together for a while now to develop and roll out a network of fast chargers for electric vehicles,” said Paul Ridden in New Atlas.

One important collaboration has made the news and both participating BMW and Porsche issued news releases about the project.

“BMW AG and Porsche unveiled a charging station that can jolt electric vehicles with enough power to drive 100 kilometers (62 miles) in less than three minutes, pushing ahead of Tesla Inc. in the race to make battery-powered cars more convenient,” reported Chris Reiter, *Bloomberg*.

[Ed. 62 miles in three minutes is just



Photo: BMW Group

under 21 miles per minute or over 1200 miles of charge in an hour, or just over three times what a Tesla SuperCharger delivers at peak. We have hereby established the charging rate. An initial jolt, however, is great for a short boost.]

The research project is “FastCharge” and it has launched its inaugural prototype 450kW fast charger. The “FastCharge” is being run by an industry consortium made up of big names such as Siemens, Porsche and BMW, and they presented a prototype for a charging station. Launched in Bavaria, the 450kW DC fast charger is said to be capable of charging a car up to 100km (62 miles) of range in less than three minutes or, as *Autoblog* added, a full charge in 15 minutes.

[Ed. This is where eyebrows will raise. The charging ‘rate’ will not be a linear time function but instead taper down exponentially. All current EVs will suffer from two things when subjected

to his kind of punishment. Heat buildup and a long term degradation of the pack life. Nissan warned LEAF owners early on of too many DC FC sessions. Heat removal can potentially be mitigated but thermal events take time to manifest themselves. Prudent handling of these kinds of “jolts” in high temperature environments means throttling the charge rate. So owners can expect there to be a cost for doing such charging regularly.]

Why this is a big deal, in numbers: “The charging capacity of the new FastChargers is three to nine times as high as what is currently possible with DC rapid-charging stations,” said a news release. Why this is a big deal for Porsche: It was the Porsche research vehicle that could achieve a charging capacity of 400 kW initially – a first for a passenger car.

[Ed. Having rapid charging available

continued next page



[Ed This Efacec DC Fast Charger comes in three models.
See <https://electricmobility.efacec.com/ev-high-power/>] Photo: Porsche

is laudable, but establishing a large well thought out network with remote monitoring in drivers' vehicles is an expensive but necessary next step. Tesla costs are approximately \$20K per stall in the US. Without a widespread network, these are just early bragging rights. "Bring it!"

Specifically, this was "A Porsche research vehicle with a net battery capacity of approximately 90 kWh achieved a charging capacity of over 400 kW on the new charging station, allowing for charging times of less than three minutes for the first 100 km range," said the December 13 company news release.

A BMW blog said, "This new station is said to be free of charge to use and capable of powering any electric car with a Type 2 charging port."

In other words, it is suitable "for electric models of all brands with the

Type 2 version of the internationally widespread Combined Charging System (CCS), as is commonly used in Europe."

What about the cooling system? Reiter in *Bloomberg*: "For the test vehicles to withstand the full electricity surge, Porsche used a cooling system that keeps battery cells at a steady temperature, while the charging cables were cooled too. Siemens provided a higher electric voltage energy supply to test the limits of the power jolt."

Green Car Congress also discussed cooling—how is this resolved in fast charging with high performance? To meet requirements, cooled High Power Charging cables from Phoenix Contact were used. "The cooling liquid is an environmentally friendly water-glycol mixture," said the report.

[Ed. First disclosed in operation in Mt. View, CA at a Tesla Supercharger in the summer of 2014, their cables were

also liquid cooled. Subsequently, the apparatus was removed, ostensibly to be deployed in some future offering (perhaps the upcoming updated Supercharger Version 2.0.)]

"One challenge was not to squeeze the cooling hoses in the charging line when connecting to the charging station, as would happen with a conventional cable, as this would affect the cooling flow and thus the cooling capacity. This problem was solved by Phoenix Contact with a specially developed wall duct with defined interfaces for power transmission, communication and cooling as well as integrated strain relief."

Car and Driver's Clifford Atiyeh said, "To put this kind of charge into perspective, most battery-electric and plug-in-hybrid cars have onboard chargers that can accept only a small fraction of the Bavarian station's output, at around three to eight kilowatts when connected to AC. That's why they take so long to recharge."

All in all, "Charging an electric car in the same amount of time that it takes to refuel a vehicle with a combustion engine would be a major breakthrough," said Greg Synek in *TechSpot*.

The BMW post said that "a higher-speed, large-network electric charging infrastructure is coming and that will be a huge leap forward for the advancement of electric vehicles."

[Ed. When? Automakers that invest in a charging network will reap the most benefits whereas waiting for someone else to provide it will hurt us all.]

<https://techxplore.com/news/2018-12-fastcharge-prototype-station-three-minute-feat.html>

More information: — <https://newsroom.porsche.com/en/company/porsche-fastcharge-prototype-charging-station-ultra-high-power-charging-technology-electric-vehicle-16606.html>

<https://www.press.bmwgroup.com/global/article/detail/T0288583EN/research-project%E2%80%99Cfastcharge%E2%80%99D:-ultra-fast-charging-technology-ready-for-the-electrically-powered-vehicles-of-the-future>

GM EV Strategy Last Chance for Cadillac's Success: Executive

General Motors Co's strategy to make its luxury Cadillac marque its lead electric vehicle brand is the automaker's final opportunity to turn the unit around and make it a success, a top executive said.

"We don't have any chances left with taking Cadillac to a really new place," newly appointed GM President Mark Reuss told Reuters on the sidelines of the Detroit auto show. "This is pretty much it."

"So we really have to hit the ball here," he added. "It's my job to make sure we do."



In a move first reported by Reuters, GM said that a Cadillac would be the first vehicle built on the No. 1 U.S. automaker's "BEV3" platform to challenge electric carmaker Tesla Inc.

Tesla's market capitalisation is higher than GM's, even though Tesla has never posted a full-year profit.

Reuss did not elaborate on what would happen if the multi-year effort to make the Cadillac brand more profitable failed.

But GM has demonstrated repeatedly over the last two years a willingness to exit unprofitable markets and kill weak car lines in North America. In November it put five North American factories, including four in the United States, on notice for closure and cut almost 15,000 jobs.

GM has struggled for years to make Cadillac more competitive. Last spring the automaker replaced veteran auto

executive Johan de Nysschen as head of the Cadillac brand. Appointed in 2014, he outlined bold plans to reshape Cadillac's lineup with a \$12 billion product programme.

He moved Cadillac's headquarters to New York in 2015, saying the brand's executives should be closer to the urban customers who had for years shunned it.

In a belated bid to catch up with rapidly shifting U.S. consumer preferences, Cadillac said in 2017 it would shrink its lineup of sedans and add sport utility vehicles and hybrid and electric vehicles.

Cadillac U.S. sales fell more than one percent in 2018.

In Detroit GM unveiled its new 2020 Cadillac XT6 SUV that goes on sale later this year and will be built in Spring Hill, Tennessee.

GM said in 2017 it planned by 2021 to introduce a new dedicated flexible electric vehicle architecture and an advanced battery system to support the development of at least 20 new models in the United States and China. Much of Cadillac's future growth is expected to come from China, the world's largest car market.

Reuss said "one of the first" fully electric Cadillac models using the new platform would be on the market around 2022.

He said it was too early to tell how long it would take for Cadillac's entire lineup to become electric, but he anticipated a combination of electrified and combustion engine models "for quite a few years" to come.

"All I'm focussed on is what we're doing right now..." Reuss said, "and getting momentum back in Cadillac."

<https://auto.economictimes.indiatimes.com/news/industry/gm-electric-vehicle-strategy-last-chance-for-cadillacs-success-executive/67540910>

Up Close with Rivian's R1t Electric Adventure Truck

For when you need your pickup to drop the hammer on a Corvette.

By Andrew Tarantola

After nine years of design and development, automotive startup Rivian unveiled not one but two new electric vehicles (each with Level 3 autonomy, no less) on Tuesday at the 2018 Los Angeles Auto Show. The R1T is a pickup built specifically for off-road adventuring while the swanky R1S is competing with Range Rover's line of upscale SUVs in both looks and amenities.

Both vehicles are built upon Rivian's "skateboard" frame construction, wherein the entirety of the drivetrain and power storage sit even with or slightly below the frame of the vehicle the same way a skateboard's trucks, spacers, wheels and bearings all sit underneath the deck. This, along with the fact that there is no engine or driveshaft (since the motors in each wheel make it AWD), frees up a huge amount of space for designers to work with. The R1T's hood lifts up to reveal 330 liters of cargo space — in what the company calls the vehicle's front trunk, or frunk — the rear cargo bed offers nearly two square meters of flat space in which to pack, and a clever cubby hole (dubbed the gear tunnel) hidden under the rear passenger seats that runs the width of the vehicle offers another 350 liters of space for long objects like golf clubs, hunting gear or ski sets.

"So when you start with a clean sheet, you start to look at where you put different things and how you package the vehicle," Rivian founder and CEO RJ Scaringe told Engadget. "We developed [the skateboard frame] to give us a really low center of gravity and really a high level of performance. So lots of suspension adjustment, a lot of torque, a lot of power."

Unlike other luxury SUVs, whether they're gas powered or electric, the

five-passenger R1t and seven-passenger R1S are both built to live in the wilds. The Rivians offer a trio of battery packages, ranging from a 105kWh pack with a 220-mile range to a massive 180kWh pack that pushes the range to well over 400 miles. For comparison, the Tesla Model X manages -- at most -- 335 miles with its 100kWh energy-storage system. They're quick too. With the largest battery pack, these vehicles can launch from zero to 60 in 2.8 seconds. That's a tenth of a second slower than the Lamborghini Aventador and less than half a second slower than the Bugatti Veyron Super Sport's 2.4 second mark. And you're doing it in a flippin' pickup truck.

What's more, the Rivians are smart enough to drive themselves. Well, to a degree. Both models will offer Level 3 autonomy (you can take your hands and eyes off the road for short periods while on the freeway) when the R1T and R1S launch in 2020 and 2021, respectively. Even better, they don't even really need roads to drive themselves: They can navigate everything from dirt roads to deer trails without needing the driver to guide them.

The rest of their specs are nothing to sneeze at, either, what with the R1's 5,000kg towing capacity and ability to scale 45-degree inclines. And since these vehicles don't need to breathe like internal-combustion engines do, they can drive through up to a meter of water without issue. Disclaimer: Don't be stupid and think that this gives you a pass to ford across flooded roadways. Don't drown, turn around.

Despite being well appointed with dual touchscreen monitors acting as both the instrument cluster and infotainment system, the Rivian vehicles are

built to spill... or rather built for spills, as the seats, carpeting and floorboards are designed for easy cleaning. I especially dug the built-in air compressor on the R1T. Using air from the suspension, drivers will be able to top off the pressure on their 4x4s, mountain bikes and inner tubes without having to drag along a separate compressor and current inverter.

The R1T is slated to cost \$61,500 and the R1S \$65,000 with applicable tax credits, depending on options and battery sizes, when they go on sale at the start of the next decade. They'll be produced here in the US — specifically at an old 2.6-million-square-foot Mitsubishi plant near Normal, IL that the company acquired and converted for its use.

"We'll start in the thousands of units, and we'll ramp," Scaringe said. "And then we have four other products on the skateboard, which we haven't shown yet, all of which speak to this idea of adventure and exploring, have a lot of functionality, a lot of performance, a lot of efficiency, of course, being electric architecture, that we'll be showing over the coming years."

Granted, 2020 feels a lifetime away, and there's a good chance that Rivian could flame out like Faraday Future did before any of its vehicles actually hit the road. But if these folks are successful, I have no doubt that they'll revolutionize the electric-vehicle market in ways that Tesla has only dreamed of.

[For more info about these products displayed at the LA Auto show, read relevant articles in the December issue of *Current Events*, starting on page 30. Read the rest of this article at the URL below. Additional reference info: <https://en.wikipedia.org/wiki/Rivian>]

<https://www.engadget.com/2018/11/28/rivian-electric-adventure-truck-la-auto-show/#/>



Scientists Locate Nearly All U.S. Solar Panels, Examine Who Goes Solar and Why

By Mark Golden *STANFORD / PRECOURT INSTITUTE*

Knowing which Americans have installed solar panels on their roofs and why they did so would be enormously useful for managing the changing U.S. electricity system and to understanding the barriers to greater use of renewable resources. But until now, all that has been available are essentially estimates.

To get accurate numbers, Stanford University scientists analyzed more than a billion high-resolution satellite images with a machine learning algorithm and identified nearly every solar power installation in the contiguous 48 states.



Stanford scientists found and analyzed 1.47 million solar rooftop installations in the United States, a much higher figure than estimated. (Image credit: Bigstock Images)

The results are described in a paper [https://www.cell.com/joule/fulltext/S2542-4351\(18\)30570-1](https://www.cell.com/joule/fulltext/S2542-4351(18)30570-1) published in the Dec. 19 issue of *Joule*. The data are publicly available on the project's website. <http://web.stanford.edu/group/deepsolar/home>

The analysis found 1.47 million installations, which is a much higher figure than either of the two widely recognized estimates. The scientists also integrated U.S. Census and other data with their solar catalog to identify factors leading to solar power adoption.

“We can use recent advances in machine learning to know where all these assets are, which has been a huge question, and generate insights about where the grid is going and how we can help get it to a more beneficial place,” said Ram Rajagopal, <https://profiles.stanford.edu/ram-rajagopal> associate professor of civil and environmental engineering, who supervised the project with Arun Majumdar, <https://profiles.stanford.edu/arun-majumdar> professor of mechanical engineering.

Who goes solar

The group's data could be useful to utilities, regulators, solar panel marketers and others. Knowing how many solar panels are in a neighborhood can help a local electric utility balance supply and demand, the key to reliability. The inventory

highlights activators and impediments to solar deployment. For example, the researchers found that household income is very important, but only to a point. Above \$150,000 a year, income quickly ceases to play much of a role in people's decisions.

On the other hand, low- and medium-income households do not often install solar systems even when they live in areas where doing so would be profitable in the long term. For example, in areas with a lot of sunshine and relatively high electricity rates, utility bill savings would exceed the monthly cost of the equipment. The impediment for low- and medium-income households is upfront cost, the authors suspect. This finding shows that solar installers could develop new financial models to satisfy unmet demand.

To overlay socioeconomic factors, the team members used publicly available data for U.S. Census tracts. These tracts on average cover about 1,700 households each, about half the size of a ZIP code and about four percent of a typical U.S. county. They unearthed other nuggets. For example, once solar penetration reaches a certain level in a neighborhood it takes off, which is not surprising. But if a given neighborhood has a lot of income inequality, that activator often does not switch on. Using geographic data, the team also discovered a significant threshold of how much sunlight a given area needs to trigger adoption.

continued next page

“We found some insights, but it’s just the tip of the iceberg of what we think other researchers, utilities, solar developers and policymakers can further uncover,” Majumdar said. “We are making this public so that others find solar deployment patterns, and build economic and behavioral models.”

Finding the panels

The team trained the machine learning program, named DeepSolar, to identify solar panels by providing it about 370,000 images, each covering about 100 feet by 100 feet. Each image was labelled as either having or not having a solar panel present. From that, DeepSolar learned to identify features associated with solar panels – for example, color, texture and size.

“We don’t actually tell the machine which visual feature is important,” said Jiafan Yu, a doctoral candidate in electrical engineering who built the system with Zhecheng Wang, a doctoral candidate in civil and environmental engineering. “All of these need to be learned by the machine.”

Eventually, DeepSolar could correctly identify an image as containing solar panels 93 percent of the time and missed about 10 percent of images that did have solar installations. On both scores, DeepSolar is more accurate than previous models, the authors say in the report.

The group then had DeepSolar analyze the billion satellite images to find solar installations – work that would have taken existing technology years to complete. With some novel efficiencies, DeepSolar got the job done in a month.

The resulting database contains not only residential solar installations, but those on the roofs of businesses, as well as many large, utility-owned solar power plants. The scientists, however, had DeepSolar skip the most sparsely populated areas, because it is very likely that buildings in these rural areas either do not have solar panels, or they do but are not attached to the grid. The scientists estimated based on their data that five percent of residential and commercial solar installations exist in the areas not covered.

“Advances in machine learning technology have been amazing,” Wang said. “But off-the-shelf systems often need to be adapted to the specific project and that requires expertise in the project’s topic. Jiafan and I both focus on using the technology to enable renewable energy.”

Moving forward, the researchers plan to expand the DeepSolar database to include solar installations in rural

areas and in other countries with high-resolution satellite images. They also intend to add features to calculate a solar installation’s angle and orientation, which could accurately estimate its power generation. DeepSolar’s measure of size is for now only a proxy for potential output.

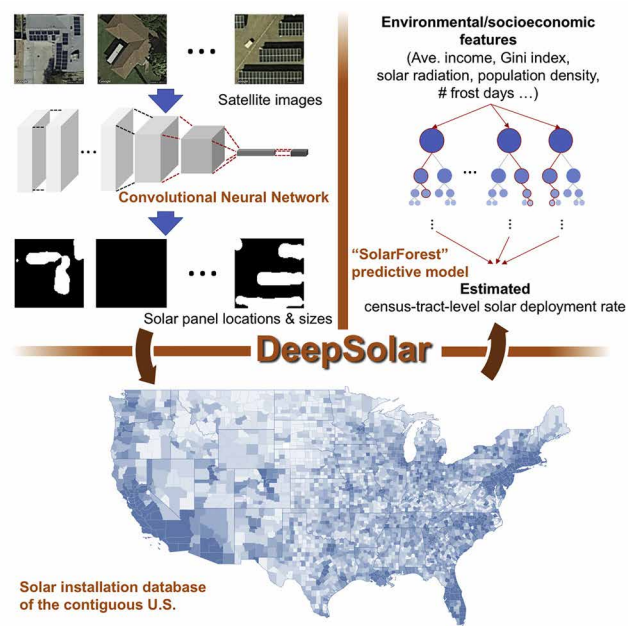
The group expects to update the U.S. database annually with new satellite images. The information could ultimately feed into efforts to optimize regional U.S. electricity systems, including Rajagopal and Yu’s project to help utilities visualize and analyze distributed energy resources.

Majumdar is also co-director of Stanford Energy’s Precourt Institute for Energy. Rajagopal is a senior fellow at the institute and directs the Stanford Sustainable Systems Lab.

Yu is supported by a State Grid Fellowship from Stanford Energy’s Bits & Watts initiative. Wang is supported by a Stanford Interdisciplinary Graduate Fellowship.

<https://energy.stanford.edu/news/stanford-scientists-locate-nearly-all-us-solar-panels-applying-machine-learning-billion>

DeepSolar: A Machine Learning Framework to Efficiently Construct a Solar Deployment Database in the United States



[https://www.cell.com/joule/fulltext/S2542-4351\(18\)30570-1](https://www.cell.com/joule/fulltext/S2542-4351(18)30570-1)

New Red Tesla Semi Electric Truck Prototype Spotted In the Wild



By Fred Lambert

We have only seen two Tesla Semi electric truck prototypes since the launch over a year ago, but it now looks like there might be a third one or at least a modified one as a red Tesla Semi has been spotted in the wild.

In November 2017, Tesla unveiled two different electric truck prototypes: a silver semi truck with aero top and wheel covers and a more rugged matte black prototype.

The former has been publicly seen over the last year as part of the Tesla Semi development program, but we haven't seen the black prototype for months after Tesla Semi was setting out on its first cargo trip with battery packs from Gigafactory 1 to the Fremont factory.

The Tesla Semi black prototype finally made a comeback earlier this month.

Now Reddit user [www.u/real_spicy_tuna](https://www.reddit.com/user/real_spicy_tuna) has spotted what could be a new Tesla Semi prototype on the 405 highway in Los Angeles.

The vehicle appears to have the same short top configuration as the matte black prototype that recently reappeared and it has a different wheel design than the silver prototype.

It's either a brand new vehicle with the same configuration or Tesla did a paint job to the existing prototype.

After Tesla revealed the pricing of its electric semi trucks last year, we learned that the regular production versions for the 300-mile and 500-mile range versions will be \$150,000 and \$180,000 respectively, while the company is also listing a 'Founders Series' version for \$200,000.

But after a year in development, Musk said that he expects that the production version could be even more efficient with a range closer to 600 miles.

Tesla originally said that it aims to bring the electric truck to production in 2019, but it was over a year ago and the company hasn't updated the timeline since.

It could be that this is the matte black prototype, but an updated version.

The matte black prototype was seen driving down from the Bay Area to Los Angeles recently and now we see a similar version but in red pop up in Los Angeles.

It may not be a coincidence, but Tesla Semi is still in its development program and it wouldn't be surprising if Tesla upgraded the prototype with new components and simply used the same chassis.

They could have given it a fresh paint job to mark the fact that it's a new/more advanced version of the prototype.



Fred is the Editor in Chief and Main Writer at Electrek. He mainly covers electric vehicles, autonomous cars and ride-sharing platforms. You can read his work on Electrek, [9to5mac.com](https://www.9to5mac.com) and [9to5google.com](https://www.9to5google.com)

<https://electrek.co/2018/12/28/tesla-semi-electric-truck-red-prototype/>



Porsche Taycan is Already Attracting Strong Interest from Tesla Owners

By Yoni Heisler

The Porsche Taycan is without question one of the most highly anticipated cars of 2019. Set to be officially revealed later this year, the Taycan represents Porsche's first big push into the realm of electric cars and, from what we can tell so far, it might actually give Tesla a run for its money.

Spec wise, the Porsche Taycan isn't messing around. Impressively, the Taycan boasts a 0-62 MPH time of 3.5 seconds and can hit a top speed in excess of 155 MPH. Equally as impressive, the Taycan will be able to travel upwards of 310 miles on a single charge. What's more, Porsche has been working on a high-voltage supercharger network that will reportedly allow Taycan owners to charge up to 250 miles in just 20 minutes flat.

All that said, the Porsche Taycan — similar to what we saw with the Model S — will be a luxury car that just happens to be electric. In other words, the Taycan will offer up the same high standards of performance and design that Porsche enthusiasts have come to expect over the past few decades.

Interestingly enough, the Taycan already appears to be catching the eye of current Tesla owners. This is particularly interesting given that Porsche Cars North America CEO Klaus Zellmer last year conceded that the allure of the Model S likely cost Porsche some sales.

"We have lots of respect for Tesla — and, yes, I'm sure there are some Porsche customers, that in terms of connectivity,

digital stuff in the car and electric battery in the vehicles, didn't find the car that they wanted with Porsche so they bought somewhere else," Zellmer said last November.

Flash forward a year or so and the Taycan — which will reportedly sport a sticker price of \$85,000 — already appears to be a success. Earlier this month, for example, Zellmer told CNET that if all the current Taycan reservation holders actually follow through with a purchase, the Taycan will be completely sold out for the year.

Even more interesting, though, is that a good number of Taycan pre-orders are coming from Tesla owners.

"More than half of the people that are signing up for the Taycan have not owned or do not own a Porsche," Zellmer said. "Typically, if we look at our source of business, people coming from other brands, it's Audi, BMW, or Mercedes. The no. 1 brand now is Tesla. That's pretty interesting, to see that people that were curious about the Tesla for very good reasons obviously don't stop being curious."

Does Tesla have reason to be worried? Not necessarily. Until the Taycan actually hits the road, Tesla will continue improving upon and selling the Model S in significant numbers. Further, Tesla's fortune at this point have less to do with competition from Porsche and a lot more to do with its ability to ramp up Model 3 production. Either way, the electric car landscape is poised to become a lot more interesting this year.

<https://bgr.com/2019/01/01/porsche-taycan-vs-tesla-owners-pre-orders/>

Porsche Taycan Factory Will Help Clean the Air

Specifically, it will help break down nitrogen oxides



Porsche Mission E (Taycan). Photos: Porsche

By Joel Stockdale

The simple act of building and selling the all-electric Porsche Taycan may be a satisfactory step toward a greener planet for many people, but Porsche is going to extra lengths to make the car, and everything around it, as environmentally friendly as possible. The company announced that the Taycan's factory will help clean the air of nitrogen oxide emissions. Nitrogen oxides contribute to smog, and they're frequently created by diesel vehicles.



To do this, Porsche will place aluminum panels around the exterior of the building coated in titanium dioxide. The company explains that when sunlight hits the panels, nitrogen oxide exposed to the surface breaks down into water and nitrate. Porsche has been testing this system with a little over 1,300-square feet of panels that it says are as effective as 10 trees in the same space.



Porsche says that if the implementation on the Taycan plant goes well, it could start using the panels on additional

buildings. On top of this nitrogen dioxide reducing strategy, the company claims Taycan production will be

completely carbon neutral. So you'll be able to enjoy your \$90,000+ electric sports car pretty close to guilt-free.

<https://www.autoblog.com/2019/01/22/porsche-taycan-factory-will-clean-air/>



Porsche Plans to Produce an Impressive 40,000 All-Electric Taycan Cars Per Year

By Fred Lambert

Porsche is reportedly doubling the planned production capacity for the Taycan, its first all-electric vehicle, to a massive 40,000 units per year, according to a German report.

Previously, Porsche was reportedly planning to produce about 20,000 Taycan vehicles per year.

It doesn't sound like much, but it was an important volume for a vehicle program at the German premium automaker.

We previously reported on Porsche considering to increase the planned capacity of Taycan production, but they have now apparently made the decision to double it.

German magazine *Automobilwoche* (German and paywall) reports that they have now approved the expansion of the production capacity to 40,000 units per year.

It's hard to overstate how significant it is for Porsche.

The program would be larger than the Panamera, Porsche's flagship sedan and likely the closest competitor to their new all-electric vehicle.

At 40,000 units per year, it would become one of the company's largest vehicle programs behind its SUVs like the Cayenne and Macan.

Porsche was apparently encouraged by early reservations for the Taycan, which they opened in a few markets.



In Norway alone, the automaker says that they received close to 3,000 reservations with deposits. Normally, Porsche sells only about 600 vehicles per year in the market.

Porsche plans to bring the vehicle to production around the end of the year and the production version of the vehicle should be unveiled in Frankfurt in September.

Earlier this year, the automaker said that it "enters the electric era with the new Taycan" and shared some details about its progress toward production.

The vehicle is expected to have a range of over 250 miles, but the most impressive feature is arguably the 800-volt system, which is double the voltage of most EVs and should allow a charge rate of up to 350 kW, theoretically able to charge the car to 80% in 15 minutes.

Electrek's Take

If the report turns out to be true, it would

be awesome and show that Porsche is truly serious about its electric effort.

We're talking about a vehicle program that would almost be competitive with Tesla Model S volumes.

I think it's going to have to be competitive in terms of pricing in order to sell those kinds of volumes.

We know that Porsche wants to sell the Taycan at different trim levels, but even the base one is expected to start at around \$80,000-\$90,000.

Interestingly, that's also the starting price of the Model S now that Tesla discontinued the 75 kWh battery pack.

We are going to wait until we have all the details, but it might sound like the Model S might finally have a real all-electric competitor – though Tesla is likely to also update the vehicle by the time the Taycan hits the market.



<https://electrek.co/2019/01/21/porsche-taycan-production-40000-electric-cars/>

Why This New Electric Porsche Will be the Hottest Car of 2019



The Taycan will come in three variants.

By Mariella Moon

Porsche's Taycan will apparently come in three variants — and the top-of-the-line model will set you back as much as \$130,000. The automaker opened a deposit option program for its first all-electric vehicle, formerly known as Mission E, in mid-2018. After The Drive editor-at-large Alex Roy signed up to place a deposit, a local brand ambassador told him in an email that Porsche will build three models, namely a base Taycan, a four-wheel drive model called the Taycan 4s and its most premium one called the Taycan Turbo.

The term “turbo” is commonly associated with internal combustion engines — you know, the kind of engines that burn gasoline. It's a curious choice, since Taycan is supposed to be an all-electric car. As Roy noted, though, the

automaker uses “Turbo” for its most expensive options, and that's exactly what the Taycan Turbo is for this line-up. At \$130,000, it will cost around \$40,000 more than the other two models: the base Taycan will apparently be priced in the low \$90,000s, while the

4s will have a price tag in the upper \$90,000s. That puts their pricing in the same range as Tesla's more expensive Model S and X options, which doesn't come as a surprise since they're supposed to be a direct competitor to those vehicles.



A lot is riding on this otherwise humble four-door sedan

<https://www.engadget.com/2018/12/28/porsche-taycan-ev-prices/?yptr=yahoo>

Lotus' First Electric Car Might Be a 1,000 HP Monster

You might have to pay \$2.5 million for the privilege, too.



By Fred Lambert

British automaker Lotus Cars is reportedly finally planning to go electric with a new \$2.5 million 1,000 hp hypercar to be unveiled in the coming months and come to market early during the next decade.

The report comes from Autocar who claims that the vehicle is codenamed 'Omega' and they plan for it to compete with supercars like the McLaren P1, LaFerrari and the Bugatti Chiron.

It's expected to be equipped with impressive features to justify the £2 million-plus (\$2.5 million) price.

Autocar reports:

"To back up its price tag, Lotus will need some hefty headline numbers from its new hypercar – 1000bhpplus is touted as one target – alongside some innovative, ground-breaking technology, through not only electric motors but possibly also next-generation battery technology to improve power density and reduce the amount of cells needed. This would help keep the car's kerb weight within the realms of the "simplify, then add lightness" philosophy embedded by Lotus founder Colin Chapman."

Lotus had an early involvement in electrification through its manufacturing partnership with Tesla, but it didn't do much under its own brand since that fell through during the last decade.

Now with Geely taking a majority stake in the company, they are expected to accelerate their efforts to go electric.

The Chinese automotive company has been buying automotive brands left and right like Volvo, London taxi maker LEVC, Lynk&Co, Volvo, and now Lotus.

With an expensive all-electric hypercar, Lotus is going to not only compete with the myriad of gas-powered supercars, but also the likes of Rimac, Koenigsegg, and Automobili Pininfarina who are all going electric.

Tesla is also moving into the space with the next-gen Roadster, which is touted as having hypercar specs, but it is expected to be offered at a fraction of the price of those previously mentioned hypercars.



<https://electrek.co/2018/12/10/lotus-electric-hypercar/>

Tesla Gigafactory Tour Shows Where Tesla Continuously Drives Down Battery Costs



Originally published on *EVANNEX*.

By *Charles Morris*

Even Tesla's detractors concede that, when it comes to battery technology, the California carmaker has a lead of at least a couple of years over its theoretical rivals. The legacy brands are taking various approaches to try to close that gap, but Tesla is far from standing still. CNBC recently toured Tesla's Nevada Gigafactory, and talked with President of Automotive Jerome Guillen.

"The Gigafactory is critical to Tesla," said Guillen. "There [are] more batteries produced here for electric vehicles than in the rest of the planet combined. We would not be able to make all the vehicles we are making now if we didn't have the Gigafactory."

Gigafactory 1 runs 24/7, and churns out about two battery packs per minute — not quite as fast as "bullets from a machine gun," but already faster than "Grandma with a

walker." However, even as Tesla begins work on a new Gigafactory in Shanghai, and talks about building another in Europe, there's still plenty of room to improve both the quantity and quality of the batteries produced in Nevada.

EV industry analyst Sam Jaffe, of Cairn Energy Research Advisors, estimates Tesla's cost to manufacture a battery cell at \$116 per kilowatt-hour, which he says is "far ahead of the industry." Other carmakers' cell-level costs are around \$146 per kWh, Jaffe says. "Tesla has shown an ability and a drive to reduce both cell costs and battery pack costs. They have been planning for this moment, with this tremendous cost advantage, for a long time, and in general they have executed well on it."

CNBC's Phil LeBeau talks with Tesla President Jerome Guillen inside Tesla's growing Gigafactory (Source: *Yahoo Finance via CNBC*)

continued next page

Tesla Gigafactory 1: New Flyover Shows New Lot Ahead of Expansion



After a hold on the expansion of the structure over the last year, Tesla has made some moves for an expansion at Gigafactory 1 in 2018. Pictures from a new flyover the giant factory shows that Tesla completed a massive new parking lot, which is going to enable a new expansion of the building. Over the last year, Tesla's focus at Gigafactory 1 has been on building up production capacity in the structure for Model 3 batteries and drive units as well as Powerpacks and Powerwalls. It resulted in the actual structure remaining virtually unchanged throughout 2017, but Tesla has started making changes in 2018 – finally beginning to install its massive 'world's largest solar rooftop array'. [Read the article by Fred Lambert at Electrek]

<https://electrek.co/2018/06/07/tesla-gigafactory-1-flyover-expansion/>

Gigafactory Continued from page 34

As *CleanTechnica* reported earlier, Tesla has a three-pronged strategy to produce ever more and better batteries.

The first of Tesla's three pillars of battery creation: building more battery cell manufacturing lines at the Gigafactory. In close cooperation with cell manufacturing partner Panasonic, Tesla is steadily building out more production capacity at the Nevada facility. This not only increases the quantity of cells produced, but also gradually brings the per-cell cost down by spreading fixed costs over a larger volume of batteries.

The second pillar: improving the design of the battery cell manufacturing lines. Everything at Tesla undergoes a continual process of analysis and incremental improvement, and the Gigafactory assembly lines are no exception. Jerome Guillen told CNBC that the company is working to improve the yield, throughput, and capacity of each production line.

Again, this not only increases the quantity of cells produced, but also improves the company's financial picture. Making more batteries from the same line translates to a better return on the capital invested in each line.

The third pillar: improving the design of the 2170 battery cell. When Tesla created its proprietary 2170 cylindrical cell, it aimed to achieve the perfect balance between energy density and the amount of surface area for cooling, which has a direct effect on battery performance and longevity. However, there is still room for improvement. "The design of the cell is not frozen," says Guillen. "It evolves, and we have a very nice roadmap of technology improvements for the coming years."

Guillen believes the Gigafactory is just beginning to reach its potential. "The costs have come down and continue to come down a lot, and that has enabled us to reach profitability in the last quarter and positive cash flow as well," he said.

<https://cleantechnica.com/2019/01/05/tesla-gigafactory-tour-shows-why-teslas-batteries-constantly-improving/>



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Nikola Moves Closer to Marketing Hydrogen-Electric Trucks



Nikola's Trevor Milton spoke with TT in an exclusive interview Jan. 8 during CES. (Nikola Motor Co.)

Nikola Motor Co. founder and CEO Trevor Milton said two key customers — private fleet Anheuser-Busch Cos. and truckload carrier U.S. Xpress Enterprises — will begin fleet tests of Nikola's zero-emissions hydrogen-electric Class 8 trucks by the end of the year, as the first shoots of the necessary fueling infrastructure are emerging in Phoenix.

Milton spoke with Transport Topics in an exclusive interview here Jan. 8 during CES, the world's largest technology event.

"I wanted to redesign everything from the ground up. I can't do that if I keep a lot of the same stuff that is on trucks right now," Milton said. "We are just lucky that we started a long time ago so we are ahead of everyone. We developed our own fuel cell, our own batteries — they are more energy dense than any other battery on the market in the world."

Nikola's battery is almost 400 watt-hours per liter, he said, calling that 50% to 70% more energy dense than rival batteries.

Its 240-kilowatt fuel cell is the biggest he knows of, and there are two on board his Class 8 trucks.



Nikola's Tre is designed to be fully autonomous. (Nikola Motor Co.)

Andrew Lund, chief engineer in the product development office at Toyota Motor North America Inc., told TT he wished Nikola well.

"They are a very interesting company. Certainly they are going to produce heavy-duty trucks. So in one way they are competitors. But I view them as more of a partner in, really, growing hydrogen infrastructure. Their announced plan is to build hydrogen stations across North America. I would want them to be successful because that would bring about the hydrogen society that Toyota has believed in for so many years."

continued on page 39

Don't Miss These...

From time to time there are articles and videos we would like to bring to your attention but are not able to reproduce in this newsletter. The Electric Vehicle is continuing to be newsworthy on many different levels so when we find interesting items we will share them with you.

Videos of Interest

What a great year. Byton 2018



Made in China, by Silicon Valley developers, who were surely assisted by Mark Tarpening and Martin Eberhard... (two of the original Tesla founders since they are both local) with German hardware roots – this car may produce strong headwinds for others. When it's produced, it might be difficult to not suffer from distracted driving. ;)

<http://www.bytonblog.com/2019/01/what-great-year-byton-2018>



Reverse Umbrella for Tesla Owners



You're in your Tesla Model 3, Model S, or Model X and it's raining—hard. The problem isn't an umbrella, you have one. The problem is getting out of your Tesla while opening the umbrella before you and the Tesla interior get soaked. With this new reverse umbrella, you only have to open the door a crack, push the umbrella through the crack and push it upward. <https://www.youtube.com/watch?v=Kt95bxs9bOY&feature=youtu.be>

To learn more, visit:

<https://evannex.com/products/reverse-umbrella-for-tesla-owners>



Tesla Releases A Video Showing Us How a Model 3 Gets Made



Less than 1 minute, this video shows the assembly process in the factory, with human and robots fitting pieces at various stations along the production line. Frequent use of the stop button on the YouTube website make for a more detailed view of the process.

<https://bgr.com/2018/12/29/model-3-video-how-gets-made-time-lapse/>



Rivian – Electric Adventure Vehicle | Fully Charged



Automotive startups always need to be viewed with a little caution, but as Jonny Smith discovers, Rivian have presented a very convincing launch. A large SUV and pick up truck at the LA motor show. Most impressive.

<https://youtu.be/QMfxJEfb4lw>



Nicola Trucks

Continued from page 37

Milton said his company plans to build 700 hydrogen fueling stations in the United States over the next seven years.

The first 14 stations will be up and running by 2021, according to the company, which is based in Phoenix, where two stations are being built and each of which will produce more than 1,000 kilograms of hydrogen.

“Then we go to stations that produce 24,000 kilograms a day. We focus mainly on dominating the hydrogen-production side, and the truck is a catalyst to drive the cost of the hydrogen down. Our hope is we can share stations with Daimler or others that are interested, like Hyundai,” Milton said.

In September, Hyundai Motor Co., in cooperation with H2 Energy, will provide 1,000 hydrogen-electric heavy-duty electric trucks to the Swiss commercial vehicle market, to be delivered beginning this year through 2023. News reports said the South Korean truck maker could bring its hydrogen trucks to the United States.

A day-cab version of the Nikola truck for North America plus its flat-face, heavy-duty truck intended for the European market will be on display April 16-17 in Phoenix during an event the company calls Nikola World.

“That’s when the whole world gets to see the production truck, a beautiful, stunning truck,” Milton said. “So what we have done now is proven out that the truck works, the components function together, the aerodynamics of the truck work. The cab, the body, all that’s done. That’s the hardest part. It took five years to do, to actually make all the systems fully function together.”

As of early January, 2,500 people had reserved to attend the event, he said.

At the same time, Milton said he is looking forward to competing against the North American arm of Daimler Trucks, the world’s largest truck maker.

Daimler Trucks North America is the leader in Class 8 U.S. retail sales.

“They have their own fuel cell, although they have tens of billions of dollars invested in diesel so they can’t scrap it.

They have to transition out of [diesel] over 10 years. They will be right there alongside of us,” Milton said. “Once we do it and prove it, and they see the model working, Daimler will come right in. But there is enough room. I actually welcome it. When Daimler comes in, the world takes notice and they know it’s legit.”

Kenworth Truck Co., a unit of Paccar Inc., and Toyota announced at CES they are collaborating to develop 10 hydrogen-electric tractors for drayage operations in the Los Angeles basin — with Toyota’s hydrogen fuel cell technology going into Kenworth’s T680 trucks.

Milton referred to the effort as “research and development.”

Nikola has about 11,000 orders for its truck.

U.S. Xpress Enterprises ranks No. 21 on TT’s Top 100 list of the largest for-hire carriers in North America. Anheuser-Busch Cos. ranks No. 65 on the Top 100 list of the largest private carriers in North America.



Anheuser-Busch Cos. is one of two fleets testing the Nikola One. (Nikola Motor Co.)



<https://www.ttnews.com/articles/nikola-moves-closer-marketing-hydrogen-electric-trucks>



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Norway Sees Boom in EVs Fueled by the Government

By Mark Lewis

A silent revolution has transformed driving in Norway.

Eerily quiet vehicles are ubiquitous on the fjord-side roads and mountain passes of this wealthy European nation of 5.3 million. Some 30 percent of all new cars sport plug-in cables rather than gasoline tanks, compared with 2 percent across Europe overall and 1-2 percent in the U.S.

As countries around the world — including China, the world's biggest auto market — try to encourage more people to buy electric cars to fight climate change, Norway's success has one key driver: the government. It offered big subsidies and perks that it is now due to phase out, but only so long as electric cars remain attractive to buy compared with traditional ones.

"It should always be cheaper to have a zero emissions car than a regular car," says Climate and Environment Minister Ola Elvestuen, who helped push through a commitment to have only sell zero-emissions cars sold in Norway by 2025. The plan supports Norway's CO₂ reduction targets under the 2015 Paris climate accord, which nations last agreed rigorous rules for to ensure emissions goals are met.

To help sales, the Norwegian government waived hefty vehicle import duties and registration and sales taxes for buyers of electric cars. Owners don't have to pay road tolls, and get free use of ferries and bus lanes in congested city centers.

These perks, which are costing the government almost \$1 billion this year, are being phased out in 2021, though any road tolls and fees would be limited to half of what gasoline car owners must pay. Gradually, subsidies for electric cars will be replaced by higher taxes on traditional cars.

Registration tax on new cars is paid on a sliding scale with a premium for the amount of emissions produced. Elvestuen pledges that the incentives for electric vehicles will be adjusted in such a way that it does not scupper the 2025 target.

"What is important is that our aim is not just to give incentives," he says. "It is that we are taxing emissions from regular cars."

Using taxes to encourage consumers to shift to cleaner energy can be tricky for a government—protests erupted in



In this Nov. 26, 2014 file photo electric cars queue in the bus lane, left, on the main road into Oslo, Norway. In Norway some 30 percent of all new cars sport plug-in cables rather than gasoline tanks and although the country is planning to withdraw the subsidies and other perks for electric vehicle owners, they are also planning to have higher taxes on traditional cars.

(Lise Aserud/NTB Scanpix via AP, File)

France this autumn over a fuel tax that hurt the livelihood of poorer families, especially in rural areas where driving is often the only means of transportation.

In this sense, Norway is an outlier. The country is very wealthy after exporting for decades the kind of fossil fuels the world is trying to wean itself off of. Incomes are higher than the rest of Europe, as are prices.

Some 36 percent of all new cars sold are SUVs, which provide safety in the country's tough winters. Tesla's SUV, the Model X — the motor of choice for well-to-do environmentally-minded Norwegians — costs around 900,000 Norwegian kroner (\$106,000).

"Buying a Tesla model X is not much more expensive than buying a standard premium Volvo because gasoline cars are taxed heavily. That is also the reason Teslas sell well," says Christina Bu, General Secretary of the Norwegian Electric Vehicle Association.

The premium gas-powered Volvo XC90 SUV, for example, starts at 919,000 kroner (\$107,100) in Norway compared with \$47,700 in the U.S.

continued on page 43

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Norway EV Boom

Continued from page 41

To date, with its longer battery life, Tesla has dominated the upmarket family car space for electric vehicles, but more premium marques are entering the market, like the Audi Quattro e-tron. Demand is still outstripping supply, with Norwegians having to wait up to a year to get their hands on the steering wheels of their new electric vehicles.

Norway has pledged to reduce emissions of greenhouse gases by 40 percent by 2030, compared with 1990 levels. The country has work to do: by 2017, emissions were up three percent compared to the 1990 baseline. Cutting emissions from road transport will allow Norway to reduce the amount it has to spend buying up emissions certificates from other European countries to meet its target. The savings are likely to run into billions, potentially balancing out the cost of subsidizing electric cars.

Norway is looking to China for help in developing the market.

China has invested heavily in electric vehicles as it looks to meet its own Paris climate accord commitments, to clean up its choking cities and to get in early in a growing area of manufacturing. **In October, six percent of new cars were electric, according to the China Association of Automobile Manufacturers, up almost 50 percent from a year earlier.** The market has huge growth potential, experts say, and like Norway, the market boom has relied on government incentives.

The hope in Norway is that the sheer size of China's market will encourage the industry to develop the technology more quickly—improving battery life, for example—and force down prices.

Experts say the electric vehicle market needs to develop more for sales to keep growing.

<https://phys.org/news/2018-12-norway-boom-electric-cars-fueled.html#jCp>



Battery life on smaller vehicles is slim and the resale market is untested. Fast battery charging points are slow compared with gasoline pumps, and on Norway's often empty mountain roads, these points are uneconomical despite government subsidies for the private companies that set them up.

Even in city centers, construction of such points has not kept pace with sales. At one station in Oslo, a Tesla driver cracks open his laptop while his car charges. Another, Ida Vihovde, drums her fingers as she waits for a charging station to free up.

"If the government put up more of these it would be OK," she says beside her electric VW Golf. "Right now there are no more chargers so I have to sit and wait."

[Ed. Something else this driver might consider is noting the time of day and perhaps returning to this charger location at a different time of day? Not always possible but if it's a regular visit – she could potentially avoid congestion next time!]



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