

Electric Auto Association



CURRENT EVENTS

February 2019 Promoting the use of electric vehicles since 1967 Vol. 51 No. 2



SMALL BUT POWERFUL, THE SOLO IMPRESSES!

Perfect for highway and city driving (Photo Electra Meccanica & CleanTechnica). See page 6



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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

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Lack of Free Choice for Clean Fueled Vehicles is Un-American

A Real Obstruction to EV Adoption

It's so American to have free choice – to have a free market. As Americans, when we purchase, we are accustomed to and enjoy a wide selection of choices. To make good decisions, we do market research because there are so many selections for product and services in our great economy. This freedom of choice – this free market – is a core value in our country. In fact, we have a body called the Federal Trade Commission that is tasked with protecting against monopolistic practices that unfairly limit competition in order to keep our free market thriving.

In California today there are over 40 models of electric cars. Consumers can choose from sedans, SUVs, crossovers, compact, luxury cars . . . an EV for every lifestyle.

But do we enjoy free choice across the country in electric car buying opportunities?

NO.

Choices are limited in many states. All models are not available. In Minnesota, the Minnesota PEV Owners' Circle has published a list of EVs that are available in Minnesota. If you live in some states, don't even look at *Electric Car Insider Buyer's Guide*, showcasing over 40 electric vehicles. You might fall in love with an electric car that is not available in your state. My friend Jill, tried to buy a KIA Soul EV in Arizona and found that it is unavailable in her state. This is happening all over the country. Obstruction.

Lack of choice in the free market of car buying is not just a barrier to product selection, it's more than that. Obstructing a person's choice for a cleaner fueled vehicle is giving an advantage to vehicles that emit toxins into our air – vehicles that cause public health hazards and climate change. Buyers need equal access, if not preferential access to electric cars.

Consider that in this ONE area where we actually can exercise immediate control over our carbon emissions, we are obstructed. Obstructed by our own laws.

Today the car market is burdened with archaic dealership licensing laws that were originally set up to protect dealerships

from the unfair practices of manufacturers. Things have changed. Today these laws create unfair competition.

Dealer licensing laws prevent Teslas from being sold in six states. Where is the Federal Trade Commission on this one?

The reason some nine states are advantaged with greater choice are the very sensible Zero Emission policies. These states agree to hold automakers accountable to making zero/low emission vehicles accessible. In states where no such policies exist to incentivize EVs, consumer choices are limited to what the automakers choose to release, and these days that is an abundance of SUVs, trucks and luxury cars. To remove these unnecessary obstacles to a free market, all states need to get on board and become ZEV states.

This situation is un-American, anti-free market and needs to be corrected.

What can be done? Letters to the editor increase public awareness. Write letters to your legislators. Better yet, work with your chapter to get your legislators behind the wheel! Show them that the best antidote is to get the powerful to fall in love with driving electric.

On a positive note, let's give a "Thumbs Up" to Lyft, a company that is creating increased choice for EVs. Choose "Green Mode" on the Lyft app for an EV when ride sharing. Write to us when you see efforts towards more freedom of choice for clean-fueled vehicles. We welcome your ideas.

Thank you for all you do for electric vehicles.



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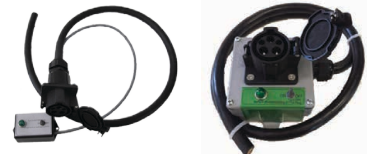
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- Use as EVSE cord or J1772 Extension
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Three Wheel EVs

Continued from page 1

By Nathalie Belanger, EAA Board

To engineers, there are advantages and disadvantages to three-wheel EVs: instead having four, it means less weight and rolling resistance. However, three wheels could also mean less traction when you need it. Yet generally speaking, this kind of EV is not for off-roading, nor cross country touring. Target usage is for local errand running and commuting short distances. Some converted electric trikes have been built, with varying successes. Front steering with motorcycle front-ends has been attempted on Chinese imports, yet rear-wheel electric drive from a single wheel has shown up repeatedly in the past 20 years.

An excellent compendium of both gas and electric 3-wheeled vehicles is at <http://3wheelers.com>.



Photo: Solo & CleanTechnica

Background

Since we have witnessed the rise and fall of the electric Corbin Sparrow, (1996-2003) and its resurrection as the Myers Motors NMG (2004-present), this article focuses on another new player: solo from <https://electrameccanica.com/solo/> which follows suit with small early production numbers and a lucrative price point for their EV.



Photo: Solo & CleanTechnica

History

The Corbin Sparrow was a small single-seat early EV. While not wildly successful, they were certainly head-turners.

There is a good summary coverage at <https://enviromotors.com/wiki/index.php/Sparro/NewbyFAQ> including what it was, how far it could go, their used cost, etc.

The home page discusses ownership, insurance, mechanical and electrical features and there is a modifications page covering changes and improvements made early on. There were not many options available for those wanting to drive electric and efficiently. That quirky yet distinctive Sparrow was an EV which sadly didn't remain 'in production' long enough at its Hollister, CA birthplace to get all its issues resolved. Later on, Myers Motors in Tallmadge, OH bought the remaining few frames and the rights and decided to reproduce them at a higher price point.

Most recently, they also introduced a two-seat version called the "half car" See <http://myersev.com>. But the single



Corbin Sparrow, circa 2002, Louwman Museum, in The Hague, Netherlands. Photo: Louwman Museum

passenger commuter EV market has really not seen anything new until 2016, when Canadian firm ElectraMeccanica in Vancouver introduced their design. They have produced a leading edge affordable 21st century rendition of this early EV, by drawing on a 59-year legacy of building and delivering high-end custom specialty cars. Who knew? But

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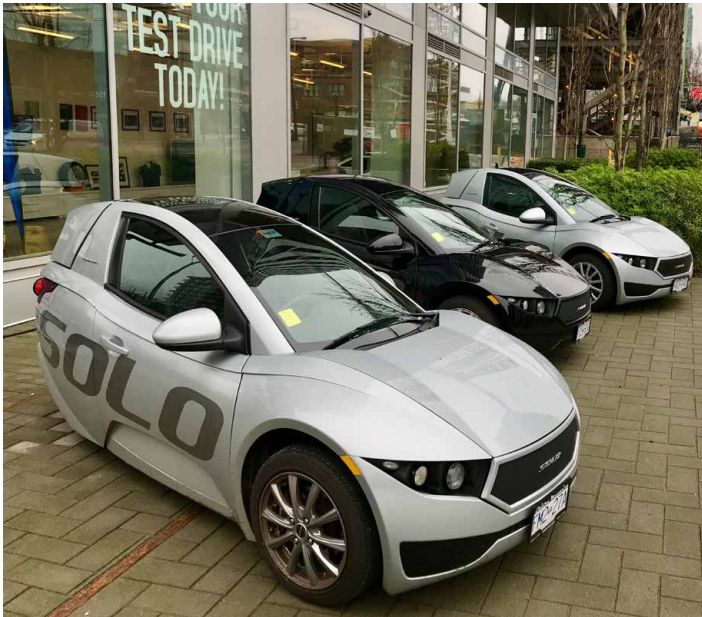
SOLO EV

look at this little EV! With two doors, a lithium battery and 100-mile capability – this one may write its own story of success starting very soon!

Starting in 1959, <http://electrameccanica.com> in Turin, Italy, the founder started creating high quality custom sports cars, then later moving to Los Angeles where he focused on building Porsche 356 replica cars. Still later they moved to Vancouver, BC. With newer partners, in 2012 the effort began on today's product. Last year, the firm started trading on the NASDAQ and the offering has

been labeled the Solo. As it is classed as a motorcycle, that inherently makes it HOV lane eligible.

Recently, I travelled to the west coast of her native Canada and paid them a visit. With my camera in hand, you can see that they have created something pretty successful.



Three new licensed Solo EV finished vehicles, ready for purchase outside of factory.



The Solo 'frunk' (front trunk) can hold two soft daypacks, umbrellas or groceries. (Actual volume here is TBD.)



Rear hatch open (backup camera on lid, at very top of frame.) Electric window switch, door release along with door storage compartments are visible. The J-plug EVSE connection is protected underneath the license plate.



The author, ready to "take it for a spin"!

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Three Wheel EVs *Continued from page 7*



Ready to roll, demonstrator unit in Vancouver.



Interior dash viewed from right side door (one of two).



Side view of Solo frame with front crumple zone, Lithium batteries nestled low on either side of seat, on display at factory.



Light-weight belt driven rear wheel hub



Rear-end view of drive and J-1772 plug assembly at top, on open frame display unit.



Front steel frame, with visible master brake cylinder, and 12 volt boost charger on display unit. Two samples of strong but light-weight honeycomb composite chassis material rest on top, either side of the steering wheel.

continued next page



Close-up of cross section of Solo's light weight chassis and body material.

Full Technical Specifications

- Top Speed 82 MPH / 130 KPH est*
- 0-60 MPH (0-100 KPH): 8 seconds est*
- Rear Wheel Drive
- AC Synchronous Electric Motor
- Electric Motor Power Output: Up to 82 hp
- Drag Coefficient: 0.24 est*
- Power Source: 17.3 kWh Lithium Ion Battery
- Torque: 128 ft-lbs
- Curb Weight: 1,488 lbs / 675 kg (estimate)
- Chassis: Lightweight Aerospace Composite
- Dimensions Length 122 in (3.10 m)
- Width: 52 in (1.33 m) – at the front wheels
- Height: 53 in (1.34 m)
- Ground clearance: 5 in
- Wheelbase: 80.5 in (2.04 m)
- 15" Aluminum Alloy Wheels (Platinum Silver)
- Tires: 155-60 R15 (Front) – 175-55 R15 (Rear)
- All-Wheel Power Assisted Disc Brakes
- Power Assisted Steering
- Daytime Running Lights
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- Air Conditioning (mandatory option)
- Heated Seat
- Cargo Space: 5 ft³ (160 Liters)
- Carpeted Trunk
- LED Headlamps
- Heated External Mirrors
- Two Speed Intermittent Windshield Wipers
- Available Colors: Titanium Silver, Electric Red, Raven Black, Arctic White

Factory Visit

During late January, I visited the factory. While not an ideal time of year to visit this wonderful city, my intention was to check out this product offering first hand, to get an impression. In driving around the city of Vancouver, I found the Solo to be surprisingly responsive. It handled curves well and provided good acceleration and braking. The cabin is cozy but not cramped. Having windows on both sides made me feel like I was flying a jet. Its unusual shape does draw some attention. The vehicle is big enough to be recognized as 'lane worthy,' whereas sometimes an e-scooter just gets shoved aside by larger vehicles, causing road rage. I feel that this new product will occupy it's own space to 'command respect,' so I would definitely consider this vehicle for a daily commute.

An additional new three wheeler EV offering includes a promised Sondors, from So. California; the company had announced that they expected production to happen in April 2019. Read about it here:

<https://www.engadget.com/2018/02/05/sondors-three-wheeled-ev-test-drive/>

[Ed: Thank you to Nathalie Belanger for contributing to this article and sharing her photos.]





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News

FHWA Awards More Than \$10 Million to Seven States to Test New Ways to Fund Highways

WASHINGTON — The Federal Highway Administration (FHWA) announced \$10.2 million in Surface Transportation System Funding Alternatives (STSFA) grants to seven states to test new ways to finance highway and bridge projects. The program's goal is to allow states to test user-based alternatives to support the Highway Trust Fund, which (to date) relies primarily on the federal gas tax.

"These grants provide states with the opportunity to explore innovative new ways to help pay for infrastructure improvements and maintenance," said Deputy Federal Highway Administrator Brandye L. Hendrickson.

The STSFA grants fund projects to test the design, implementation, and acceptance of user-based alternative revenue tools. FHWA officials selected proposals from seven states – California, Delaware, Minnesota, Missouri, New Hampshire, Oregon, and Utah.

The seven projects will investigate and evaluate various mileage-based and road-user charges, including for trucks and automated vehicles, and the implementation and operation of the technologies at a regional level. [Ed. We believe the funding will expire later this year. Which project will be selected if any is unknown. Our government many fund additional grants to study the results of these studies (called a meta-study).]

STSFA was established under the "Fixing America's Surface Transportation" (FAST) Act.

FY 2018 STSFA Grant Selections

Top line of the groupings: State (& other partners)

Middle line: Project/Description

Last line: Funding

California Department of Transportation (Caltrans)

Exploration of California's Road Usage Charge Program (RUC) with emerging technologies and services, such as Usage-Based Insurance (UBI), Transportation Network Companies (TNCs),

and Autonomous Vehicles (AVs).

\$2,030,000

Delaware Department of Transportation (DelDOT) – I-95 Corridor Coalition

Use of mileage-based user fees in a multi-state region. The project addresses the requirements for implementation, interoperability, public acceptance, and other potential hurdles across state lines.

\$3,028,000

Minnesota Department of Transportation (MnDOT)

Demonstration of the feasibility of distance based user fees through the shared mobility model, such as Mobility-as-a-Service (MaaS) providers.

\$999,600

Missouri Department of Transportation (MoDOT)

Deployment of innovative strategies such as a vehicle registration fee along with other used-based charges.

\$1,782,500

New Hampshire Department of Transportation (NHDOT)

Exploration of road user charges levied in conjunction with vehicle registration fees.

\$250,000

Oregon Department of Transportation (ODOT) – Western Road User Charge Consortium (AZ, CA, CO, ID, HI, MT, NV, OK, OR, UT, and WA)

Exploration of Road Usage Charge and Automated Vehicles at both the state level and in a regional interoperable system.

\$950,000

Utah Department of Transportation (UDOT)

Utah will pilot a road user charge program for alternative fuel vehicles including hybrid and electric vehicles.

\$1,250,000



<https://www.fhwa.dot.gov/pressroom/fhwa1902.cfm>

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for Individuals, Groups and Organizations

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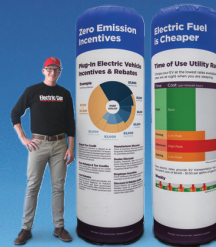
EV Buyers Guide

Compare electric cars with comprehensive full page profiles



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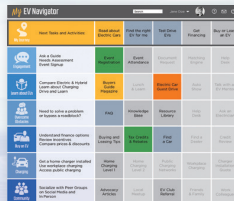
Educational Exhibits

Large scale interactive exhibits for indoor and outdoor events



Electric Car Guest Drive

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

2019 Hyundai Kona Electric Drivers' Notes Review I Living, Loving The Life Electric

We're quite pleased with Hyundai's EV hatch



By AutoBlog Staff

The 2019 Hyundai Kona Electric isn't Hyundai's first production EV, but it's the first with truly usable range at 258 miles. It even beats the benchmark Chevy Bolt EV in that regard. Add to that 201 horsepower, 290 pound-feet of torque, a popular crossover wrapper and seating position, and the little EV is seemingly poised for success. Of course, success is contingent on the Kona Electric being a good car to drive, so we brought one to the office and even tried it out in snow and bitter cold. Overall, the Kona left our spirits high. Read on.

Editor-in-Chief Greg Migliore: The Hyundai Kona is cute, efficient and



a smart play for Hyundai, which is increasingly offering a wide range of electric choices for consumers. The

plug-in has a better range than the Chevy Bolt, and the price is reasonable.
continued next page

The Kona is a little small for family use, but it's excellent as the second car or commuter. EVs are fun to drive, and this one served up a torquey yet still smooth experience. I really enjoyed running around town in this thing. Only complaint: the interior felt a bit cheap. This one was gray and the materials were plasticky, which isn't the right vibe. But overall, I'm impressed with the new wave of more accessible EVs with strong range, and Hyundai is at the forefront.

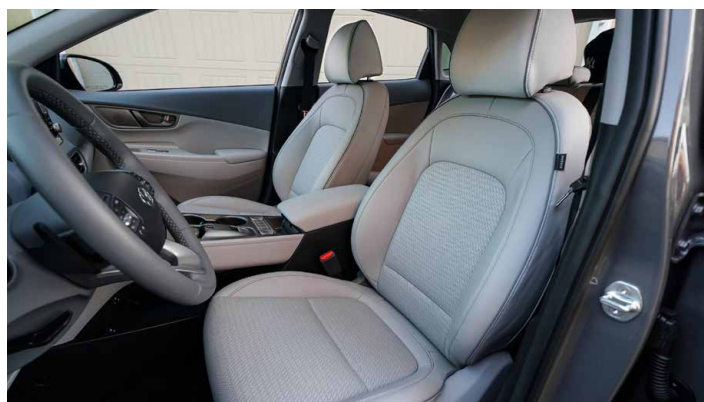
Senior Editor, Green, John Beltz Snyder: I love this car. The gas-powered Kona didn't strike me as anything special: It looked cool, was easy to drive, and I recalled the back seat being a little small. The EV, though, is a car I won't soon forget.

I put a lot of miles on the Kona EV over the weekend, driving from Birmingham, Mich., to Detroit, from Ann Arbor to East Lansing and back, and running a number of errands around town. With only the Level 1 mobile charger to refuel at home, I couldn't add a ton of miles to the car between drives. With temperatures in the teens and a heavy right foot, I can't tell you how much real-world range I got, because I never drove the car from 100 to zero percent battery. I'm sure it wasn't anything like its 258-mile rating, but it didn't matter. I had more than enough range at about a three-quarter charge to drive 65 miles to my grandma's and back.

My first night in the car, I diced it up in Woodward traffic before setting a brisk pace on the highway to meet my wife and son in Detroit. I started with the car in Eco mode, which felt amply quick and responsive to accelerator input. I dialed in full regen with the left paddle on the back of the steering wheel. I only had to use the brake when coming to a complete stop.

A little later I put it in Sport, turned down the regen feel, and took full advantage of the low-end torque and quick, linear acceleration. I was having some serious fun in the Kona — there's something about the quietness that makes an EV like this satisfying to drive fast. My fast clip home from Detroit saw me pulling into the driveway at the same time as my wife, despite that I had stopped to pick up dinner.

I was a little concerned about stuffing my son in the back of the Kona EV. Opening the back door, though, there appeared to be more room behind the front row than I remembered in the Kona. It was a little tricky getting the tall car seat through the door opening, but once I had the seat installed and my boy strapped in, he had plenty of room to swing his long legs around. With 140-ish miles of stated range in the battery,



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Kona Electric Review

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we headed off on the 65 miles of mostly highway driving to East Lansing. I kept the car in Eco mode, put on adaptive cruise control at the speed limit, and took it easy. I got a little concerned about cutting it close, so I put the car in Eco+, but quickly got cold without the heat on. On my way home, it was clear I had plenty of range, so I cranked the heat, and put the car into Sport mode again as I approached Ann Arbor.

If I had a Level 2 charger at home, I could very easily live with the Kona EV, even in the dead of winter. It's got everything I need: more than enough range, adaptive cruise control, a good infotainment system, enough room for a forward-facing car seat and fun, guilt-free driving. It would be a tough choice between this and the Nissan Leaf for me. We'll see if I change my tune further after driving the Kia Niro EV.

Assistant Editor Zac Palmer: The night I got to drive our Kona Electric tester was the same night we got about 5-6 inches of snow dumped on us here in Michigan. I took it as a great opportunity to test out the snow-worthiness of Hyundai's little electric ute.

Front-wheel drive puts the onus on the tires more times than not, and the little Kona was able to scratch and claw its way through all the snow I threw at it with the stock all seasons. In a bout of confidence, I even charged into an unplowed parking lot with about six inches of fresh powder everywhere. There were a few seconds of uncertainty as I munched about the wide open lot, but I made it out without too much of a scare. The Kona feels nimble on snow, which inspired me to toss it about in a way similar to the way I would a compact hatchback or small sedan. If a manual handbrake were used instead of the electric unit, I really would have been grinning.

The instantaneous torque delivery in the snow take a second of getting used to with traction control off, but upon learning the throttle sensitivity, the instant power becomes a real boon for snow fun. All the power you'd want to pull yourself through a corner is on demand. The challenge becomes doling out that power in a way that provides forward momentum, rather than shooting up giant rooster tails of snow with the front tires spinning like mad.

Don't be afraid to grab a Kona Electric if you live in a place with heavy snow. Fresh all seasons did the job for me, but I

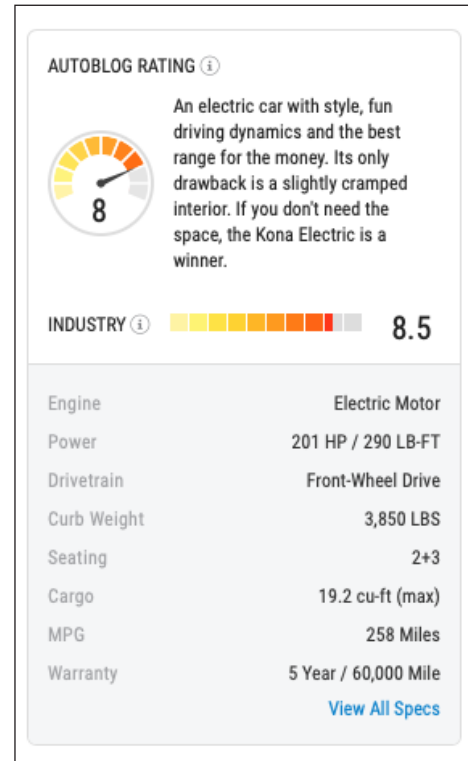


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can already tell this thing would be an electric monster with winter tires fitted.

Associate Editor Joel Stocksdales: I too, adore this little electric car. And what really won me over was how fun it is. The steering is very sharp and the car dives for turns. The torque is giggle-inducing, particularly when spinning out the skinny economy tires. The throttle response is excellent, and with full regen, it's really easy to balance the car through corners, getting the tail a little farther out off-throttle, and straightening it back out on-throttle. Oh, and it corners quite flatly. It's just a really entertaining little car. Having a limited slip differential of some sort would be appreciated, though, since it's really easy to roast the inside tire. Combine all this with great range, a stylish, easy-to-use interior and a funky exterior, and this is probably the EV I would buy.

I also spent time with the Kona Electric during the polar-vortex driven cold snap, so discovered some interesting things about winter EV life. Cold definitely effects range. Without running any sort of climate control, and having the car in normal mode, it showed about a 211-mile range on what appeared to be a full charge. Considering the bitter cold, that actually wasn't too bad. What also affects range is the climate control, and the effects can be substantial. When I turned on the heat, and kept it on the more economical "Driver Only" setting, the range would drop roughly 20 miles from before switching on the heater. I noticed something similar when I took a Chevy Bolt EV on a long trip, and kept having to keep the defogger on to keep the windows clear in the rain, though not to the same extreme. The weather at the time was far less brutal, too. What doesn't make a big difference to range is heated seats and steering wheels. So if you're going to have an EV in a cold climate, definitely option those heated parts, because they could help keep you comfortable and maintain a little more of your range.



<https://www.autoblog.com/buy/2019-Hyundai-Kona+EV/specs/>



Large Amazon / GM investment into startup Rivian



By CE Staff

The company says its electric truck and SUV will be delivered in late 2020.

Electric pickup truck startup Rivian Automotive has aroused the interest of some big backers. Amazon announced that it intends to lead a \$700 million investment along with GM. Both Amazon and General Motors acknowledge they have been in talks with Rivian but with any deal to be announced at a later date.

For Amazon, this is their biggest bet on technology that could entirely change the automotive sector. We note that recent news has Ford and others are stepping back from the sedan market. Of course, it is also a big acknowledgment of the strength of Rivian's EV tech which Amazon would potentially use in its delivery vehicles to boost its logistics network. They supposedly have also experimented with drone drops of small packages, while looking for ways that can speed delivery to shoppers' doorsteps.

With storage being pitched as a key selling point for this vehicle, this crystalized their interest.

Clearly Rivian is a newcomer in this industry. As of Dec 2018, the top ten (in millions of USD) players were: \$203 Toyota, \$82.6 Volkswagen, \$62.0 Daimler, \$54.5 GM, \$54.3 BMW, \$53.9 Honda, \$51.9 Tesla, \$35.3 Nissan, \$33.5 Ford, \$25.9 FCA. Yes, those numbers include not only trucks, but also additional market segments in which they participate. Other interesting auto industry statistics can be found here: https://en.wikipedia.org/wiki/Automotive_industry#By_manufacturer

But this investment could place Rivian's valuation at between \$3 billion and \$4 billion, which bodes well for the expensive ramping up of production at the former Mitsubishi manufacturing plant in Normal, Illinois. The company today has about 600 employees in tech-center corridors such as San Jose and Irvine, California, in the industrial heartland in

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Image Credit: REUTERS/Mike Blake

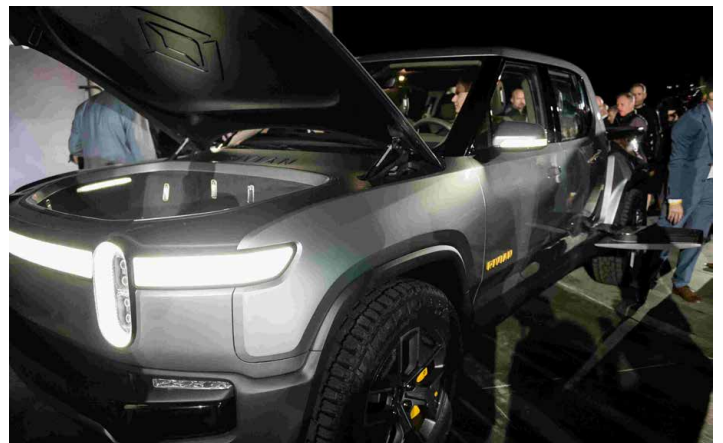
Plymouth Township Michigan, and in Illinois. Rivian aspires to be the first to produce a mass market electric pickup.

Recently, Amazon upped its investment in the automotive sector, joining a \$530 million funding round in self-driving car startup Aurora Innovation. Rivian's existing financial backers include Saudi auto distributor Abdul Latif Jameel, Sumitomo of Americas, and Standard Chartered Bank. Some existing shareholders participated in this round, Rivian admitted, stressing however, that there is no IPO on the horizon.

Tesla Chief Executive Elon Musk announced in August that an electric pickup is "probably my personal favorite for the next product". But he has spoken only in general terms saying a launch could happen "right after" Tesla's Model Y, later this year, with a production start in 2020.

Rivian unveiled its electric R1T pickup and R1S SUV for the first time at the LA Auto Show last November. (We covered this in December Current Events, Volume 50 No. 12 on page 32.) Recapping, this quad motor vehicle promised to have a battery that should capture 200 miles of range in 30 minutes of DC fast-charging or 300 to 400 miles of range for an overnight charge using the slower Level 2 charger. They claim to achieve a low center of gravity by packaging "the battery pack, drive units, suspension, braking and thermal system all below the height of the wheel. This provides packaging space above the wheel for occupants/gear.

<https://venturebeat.com/2019/02/15/amazon-leads-700-million-investment-into-electric-pickup-truck-startup-rivian/>



It sounds like a grand entry into the EV truck market, as trucks seem to be up there as America's favorite vehicle.

[More info below.]

2020 Kia Soul EV Rated for 243 Miles, Improved Efficiency

By Bengt Halvorson

In just one model year, Kia has more than doubled the rated driving range for the Soul EV.

The 2020 Kia Soul EV, which is expected to reach dealerships this spring, will go 243 miles on a charge—four more miles than the Kia Niro EV—according to the EPA, in ratings that were released recently.



The Soul EV, like two other vehicles from Kia and its sister company Hyundai, the Kia Niro EV and Hyundai Kona Electric, comes with a 64-kWh battery pack. It's closely related to the Kona Electric and built on a version of the same global small-car platform, but it shares its battery pack with the Niro EV.

While each of these 64-kWh liquid-cooled packs have five large modules of pouch cells, with three oriented lengthwise under the passenger floor and two stacked crosswise under the rear seat area, the key difference is that the Kia models use cells from SK Innovation and the Hyundai uses LG Chem cells.

The outgoing Soul EV offered just 111 miles of range from its 30-kWh battery. And it had already received a boost from 27 kWh in 2018.

The new Soul EV is more energy-efficient than before, too, as its EPA combined rating is now 114 MPGe, versus 108 MPGe before.

The key to its slightly lower range versus the Hyundai Kona Electric (258 miles) is in the city-cycle “fuel economy” results that are used for that official range calculation—127 MPGe for the Soul EV, versus 132 MPGe for the Kona Electric. That could result from slight differences in weight, tuning, or from those different battery cells (or all of the above.)

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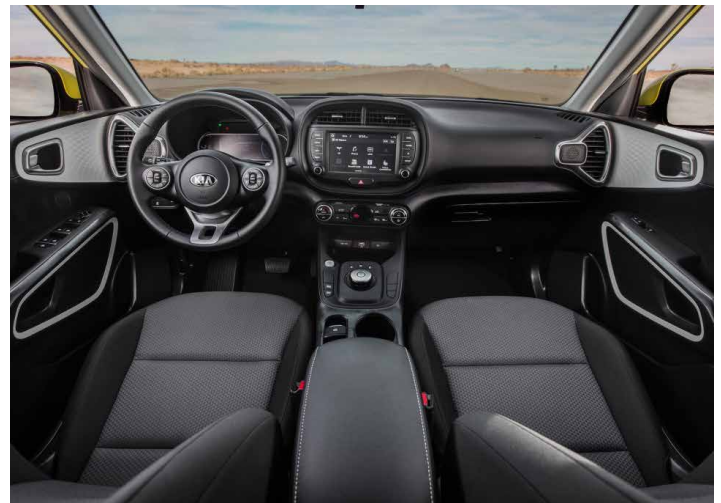




The Soul EV now also offers a longer driving range than the Chevrolet Bolt EV's 238 miles from its 60-kWh pack.

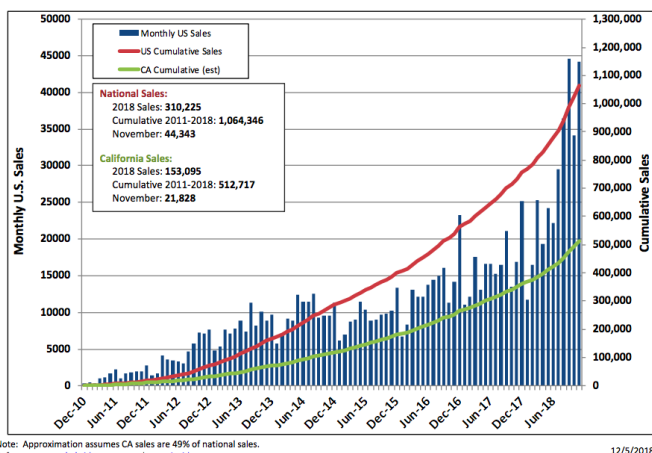
Charging is another way to look at it. Like the Niro EV, the Soul EV will get 100-kw CCS (Combo) DC fast charging that will be significantly quicker than the Chevrolet Bolt EV's official 50-kw charging, and even a bit quicker than the Kona EV's charging, which tops out around 70 kw.

With all these numbers so close, purchase decisions will come down to the features and packaging of these models. With much-boosted power and torque (201 horsepower and 291 pound-feet, respectively), a new 10.3-inch touch-screen system, and more active-safety features, this little electric urban warrior now looks set up for more than just the city.



https://www.greencarreports.com/news/1121518_2020-kia-soul-ev-rated-for-243-miles-improved-efficiency

Electric Car Industry Group Says Californians Have Now Purchased 500,000 EVs



By Megan Geuss

In November, California reportedly crossed the 500,000 threshold for electric vehicles sold in the state since 2010. Months of strong US sales in 2018, preceded by a strong 2017, are starting to show a trend: electric vehicles are selling well, especially in places where there are strong monetary and non-monetary incentives to buy them.

According to Veloz—a group of electric vehicle industry stakeholders that includes GM, Honda, Nissan, Pacific Gas & Electric, Uber, and Lyft, among others—electric vehicle sales in California hit a cumulative 512,717 since 2010.

[Excerpted from the article you can read at the URL below.]

<https://arstechnica.com/cars/2018/12/electric-car-industry-group-says-californians-have-now-purchased-500000-evs/>

ALTERNATING CURRENTS 2019

Alternating Currents Letters and Opinion Policy

Current Events welcomes letters commenting on its coverage and on topics of interest to the Electric Vehicle community. Be sure to sign your letter and please provide your address and daytime phone number so we can reach you in case of questions. Only your name, city and state will be published unless you request otherwise.

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Current Events reserves the right to edit letters for length and clarity and to correct factual errors known to us.

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Ultracaps Versus Batteries – Not The Same!

With Tesla's statement of intent to acquire Maxwell Technologies this week, various Internet blogs and forums are buzzing with articles about what this means for future EVs as well as cars. However, there is much misunderstanding about energy and power in the non-technical world. When I speak to people about their solar systems, it's apparent to me as an engineer, that this is a foreign subject to most.

"I have a six kilowatt-hour system on my roof." ERRR! (game show buzzer sound) Or "My batteries only have 10 kilowatts left in them". ERRR! We do all know that one can't "bottle up sunshine" for later use, and lately battery storage devices are making inroads into private houses today. But let's focus on EVs, for they are the future of transportation, in my opinion.

Some of these items I read seek to illuminate readers with some techy background info but leave them thinking that there still is hope for an ultra-cap only powered car, which will quickly charge, where they last forever. Normal capacitors have high internal surface areas, low losses and long life. Ultra-capacitors have electrode materials with high conductivity, low chemical reactivity and extremely high specific surface areas. That's partly why they shine. But what about their application – and how to compare them to a battery. From my recent readings, more and more people conflate the two EV oriented electrical storage devices.

Ragone plots are graphs used for performance comparison of various energy-storing devices. They are useful in the academic fields of thermodynamics, chemical and electrical engineering.

For background on these see

https://en.wikipedia.org/wiki/Ragone_plot

Batteries and capacitors both store energy, the former via electro-chemical mechanisms, the latter strictly by electro-physical means. Ultracapacitors (sometimes known as super capacitors) are just "ginormous" capacitors. Normal caps are measured in micro farads, while ultra-caps are measured in Farads (so a million times larger). They each have strengths, and weaknesses, which need to be heeded when talking about applying them in EVs.

The operational cost of any energy storage device heavily depends on its respective capacities which will fade over time, due to varying charge and discharge efficiencies during subsequent charge/discharge cycles. Capacitors have very little of this degradation, which bodes well for them, and makes them attractive to EV OEMs.

Batteries, on the other hand, are expensive and fade after thousands of (presumably daily) cycles. But both are large, with batteries being heavier. In a car, 4-5,000 cycles could be acceptable. But after that the batteries don't just stop functioning – they just hold less energy than when new, meaning the maximum fully charged driving range is reduced. This has prompted the EV industry to establish 70% to be the threshold of capacity, below which vehicle utility is sometimes considered "impaired".

From first hand crowd-sourced experience, Tesla owners have established that point to be over 20 years beyond the date of leaving the factory! Most owners will not keep their cars that long, but that fact probably will enable the 2nd 3rd and 4th owners to enjoy the car.

continued next page

Looking at a Ragone plot below with its log-log axis – ultra-caps sit near the bottom to the right. (Figure credit to Kosala Gunawardane, in his book *Energy Storage Devices for Electronic Systems*, 2015.)

<https://www.sciencedirect.com/book/9780124079472/energy-storage-devices-for-electronic-systems>

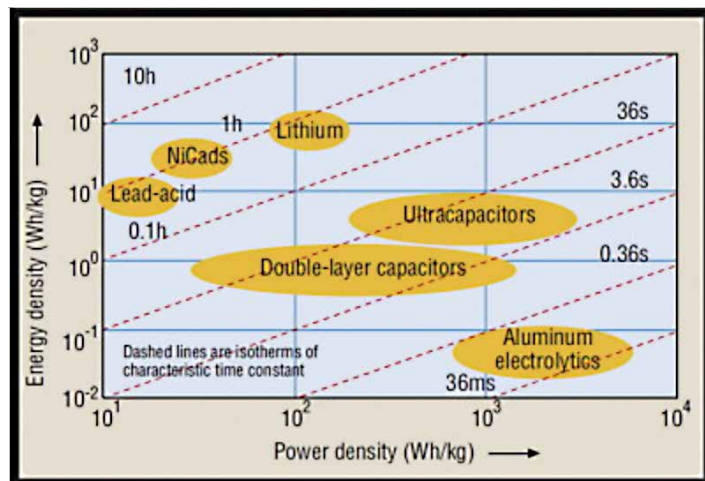


Figure 4.12. The Ragone plot showing energy density vs. power density (Kim, 2003).

Battery performance characteristics for EV applications can best be described in terms of two parameters, specific power and specific energy. Specific power relates to the speed of vehicles and acceleration (Volts x Amps/mass). Specific energy relates to driving range (Volts x Amps x Time/mass).

Being near the bottom means they can't very well be used as a long-term source of energy; therefore, so they won't do much for an EV. They will deliver a jolt of power, great for acceleration, but not for "cruising on the boulevard".

An example of this follows. About 10 years ago, after GM had scrapped the EV-1 project and became the object of shame as shown in the movie *"Who Killed the Electric Car?"* directed by Chris Paine, GM tried to save face. They donated about two dozen EV-1 (badly crippled and not drivable) to universities nationwide. Some were displayed in museums, ranging from The Petersen Museum in Los Angeles to a national automotive museum in Shanghai. When Western Washington University students equipped an EV-1 with only ultra-caps as an experiment. It quickly made its way down the 1/4-mile dragstrip but barely made it back to the starting point! It didn't have "any range" to speak of.

That underscored the lack of specific energy in the capacitors, immediately relegating them to the second-tier usage in cars.

Since that time, not much volumetric improvement for ultra-caps has been seen, which is another issue needing to be addressed.

Truth be told – today's batteries already do a very credible job of delivering power, as well as an excellent job of delivering energy. (Again, power is in short bursts, energy is power drawn over an extended period of time – hence the unit of watt-hours).

They are improving, with pace moving along very nicely (with ~8 to 10% CAG for the past three decades), along with density increases and cost decreases. Current research being investigated for electrical energy storage focuses on carbon-based materials, 2-dimensional nanomaterials, conductive metal organic frameworks (MOFs), and redox-active polymers, etc.

But even such interesting research often ends up as a report in a file cabinet, stymied by some unforeseen stumbling block. When collaboration occurs, results may be combined and implemented sooner in a product. I believe Tesla's recent acquisition has roots in their desire to totally rid their cells of cobalt, and with their current percentage at less than 3% of total active material, they will soon have achieved that goal. (We're told "in next generation", whenever that happens.) But also, their adding Maxwell Tech's Dry Battery Electrode (DBE) process to their portfolio may well accelerate the advent of this "next gen" cell.

See the abstract of this research paper:

<http://www.powersourcesconference.com/Power%20Sources%202018%20Digest/docs/3-1.pdf>

Further, if this new process is dry to begin with, it hints that the Gigafactory may consume less energy for their cell process manufacturing line due to lower heating requirements to do drying of their current wet process line. That helps drop their costs. The end result will then be applied either to their PowerWall / PowerPack or the EV products or both.

Of course, only time will tell. While I can't read the future, my assertion is that we simply don't know where this all will lead to. And I don't believe this part of Tesla's IP will be openly shared for a quite a while. So speculation will continue until something gets announced. As all engineering, in the end results are often a compromise. Today's EVs are good; those coming soon will be even better. 

AAA: Cold Weather Can Cut Electric Car Range Over 40 Percent

[Ed. This common sense study reveals the obvious. Cooling an EV costs range, heating one costs even more. There simply is no “excess heat” to be had in EVs, like in those inefficient ICE cars which only get 20% of gasoline energy content transferred to the wheels while driving. The difference is lost as unrecoverable waste heat!]

But it can keep you comfortable. In an EV, there is no such massive inefficiency. It's about three to four times more energy efficient than a gasoline powered pollution-mobile! When buying a new EV, if needed, consider getting that “winterization package” if it's offered! Long time EV owners may know all of this.

*Why is this so? Physics explains it all:*** Cold air is denser than warm air, requiring more energy to get thru it.*

** Wet and icy roads reduce traction; requiring more energy,
* Staying comfortable while driving requires energy which has to come from your battery.]*

By Tom Krisher

Cold temperatures can sap electric car batteries, temporarily reducing their range by more than 40 percent when interior heaters are used, a new study found.

The study of five electric vehicles by AAA also found that high temperatures can cut into battery range, but not nearly as much as the cold. The range returns to normal in more comfortable temperatures.

Many owners discovered the range limitations last week when much of the country was in the grips of a polar vortex. Owners of vehicles made

by manufacturers including Tesla, the top-selling electric vehicle company in the U.S., complained on social media about reduced range and frozen door handles during the cold snap.

“As long as drivers understand that there are limitations when operating electric vehicles in more extreme climates, they are less likely to be caught off guard by an unexpected drop in driving range,” Greg Brannon, AAA’s director of automotive engineering, said in a statement.

AAA tested the BMW i3s, Chevrolet Bolt and Nissan Leaf from the 2018 model year, and the 2017 Tesla Model S 75D and Volkswagen e-Golf. All have a range of at least 100 miles per charge. They were tested on a dynamometer, which is like a treadmill, in a climate-controlled cell.

The automobile club tested the cars at 20 degrees and 95 degrees, comparing the range to when they were tested at 75 degrees Fahrenheit, according to a report on the study.

At 20 degrees, the average driving range fell by 12 percent when the car’s cabin heater was not used. When the heater was turned on, the range dropped by 41 percent, AAA said.

At 95 degrees, range dropped 4 percent without use of air conditioning, and fell by 17 percent when the cabin was cooled, the study found.



In this May 27, 2018 photo, a 2018 Model X is plugged into a charging station at a Tesla dealership in Littleton, Colo. Cold temperatures can sap electric car batteries, temporarily reducing their range by more than 40 percent when interior heaters are used, a new study found. The study of five electric vehicles by AAA also found that high temperatures can cut into battery range, but not nearly as much as the cold. The range returns to normal in more comfortable temperatures. (AP Photo/David Zalubowski, File)

For example, AAA’s testers determined that the Tesla’s range when fully charged at 75 degrees was 239 miles, but it fell 91 miles, or 38 percent, at 20 degrees.

In a statement, Tesla disputed the AAA results. The company said that based on data collected from its cars on the road, “the average Model S customer doesn’t experience anywhere near that decrease in range.” The company said the range dropped by roughly 1 percent at 95 degrees, but it would not release a percentage for cold weather.

AAA said it followed test procedures drawn up by SAE, an auto engineering trade group.

When the temperature tumbled to 20 degrees last week in Hickory, North Carolina, near Charlotte, Jason Hughes noticed the range fall when he drove his Tesla Model 3 on the commute from home to work.

continued next page

Here's How A Tesla Model 3 Actually Fares In The Winter



[The photo above is from the video that is being reviewed. Below is the excerpt of the review with a little different viewpoint of winter driving with a Model 3. The video is worth looking at.]

By Steven Loveday

We've heard the Tesla Model 3 fares well in winter conditions, but may not be the best choice for a cold-weather car. Here's another look.

Many of you may know, depending on where you live, that winter has set in early in many areas. It's as if the fall season never really happened. We went from the heat of summer to winter weather advisories seemingly overnight. Winter weather is a hot topic for EV owners, as well as those that are considering buying an electric car. YouTuber Andy Slye

fills us in on how his Tesla Model 3 is faring in the cold weather thus far.

Andy points out that it's important for people to understand that EVs will have less range in cold weather. His efficiency is currently at 270 Wh/mile, which means he'll lose about 15 miles of range if he keeps driving the same way in the same conditions. While gas cars also have less range in cold weather, they're not impacted as much, and most ICE cars have a longer range than most EVs. For this reason, Andy says if you live in an area that experiences cold temperatures, try to buy an electric vehicle with the longest range possible.

Aside from range, Andy is impressed with how well the Model 3 handles in the snow. It's important to note that he's driving a rear-wheel-drive Model 3 with stock tires (not winter tires). In terms of the complaints about frozen door handles and windows, Andy says he really doesn't believe that the Model 3 is a bad winter car and points out that these are common issues in many cars. Cold weather is just not friendly to our vehicles and having things freeze up can happen to anyone with any car.

[Be sure to read the comments shared by readers]

<https://insideevs.com/tesla-model-3-winter-weather/>

AAA Cold Weather *Continued from page 22*

"It would easily use double the amount of power for that 15-mile trip," said Hughes, who owns four Teslas and runs a business that refurbishes and sells salvaged Tesla parts.

The cars use energy to heat the battery coolant in cold weather, as well as for heating the cabin, Hughes said. Range would take a hit mainly for short trips, and the decrease wouldn't be as large on longer trips once the battery and cabin are heated, Hughes said.

"It's definitely an issue," he said. "If you want to go somewhere far in the cold, you're going to be using more power."

Range would be reduced further by extreme cold in northern states, he said.

AAA recommends that drivers heat or cool their cars while still plugged in to a charging station. It says electric cars can still be used in extreme climates with a little extra planning.

EAA recommendations:

- Use your seat heaters, steering wheel heaters if you have them.
- Don't set the temperature to 85 degrees and hope you'll get it warmer faster! It doesn't work that way. (Set at 85 it'll take longer to get there, work harder to keep it there, and consume more energy! Drop it to 70 degrees or less. Inside is still warmer than outside most of the time since you're protected!
- Use a higher fan setting instead of a higher heat output temperature setting.
- Try to pre-heat the cabin while at home on shore power (while plugged in).

<https://techxplore.com/news/2019-02-aaa-cold-weather-electric-car.html>

Electric Vehicles Do Work In Cold Weather

This article is part of the “CleanTechnica Answer Box” collection. In this collection of articles, they respond to dozens of common anti-cleantech myths.

Myth: electric cars don't work in the cold.

Short answer: Electric cars do work in the cold. Their driving range decreases in the cold, as is the case for all cars — because physics. However, they still function fine, and you can also pre-heat many of them.

By Jake Richardson

Critics of electric vehicles sometimes mistakenly or misleadingly try to dismiss electric vehicles by claiming that they don't work in cold weather. This view is quite untrue and easily proven incorrect. All EVs operate in cold weather. But their driving ranges do decrease to varying degrees in cold weather.

For example, the Tesla Model S 70D reportedly experiences a loss of about 19% in driving range in deep cold (0°F with the heater on), according to a post made by the Union of Concerned Scientists. [See sidebar next page.] If you read Tesla forums, some posters have written that on winter days in Chicago, they have experienced up to a 50% reduction in range.

That figure may be for multiple short trips. One poster wrote that for longer trips in cold weather his driving reduction was about 20–30%. This figure is in line with what a Nissan LEAF owner in Colorado wrote in a blog post about his experiences driving in cold weather there. “This means that in cold weather (15°F), you get about 20% less range, even though you could heat the battery to room temperature with



just 0.5 kWh (under 2%) of its energy. Or simply use wall power when it's plugged in. A 20% penalty in cold climates to avoid adding a \$100 heater. Why!?!?”

He also generously listed some of the benefits of having an EV in such weather:

The electronic traction and stability control systems work much better with an electric motor, because it can be controlled more precisely. In practice this means that while a normal car would dig itself into a rut, the Leaf applies just enough power to get through the snowbank. Or it stops the wheel, giving you a chance to reverse and give it another go.

- There's no cold-cranking worries or waiting for a cold engine to warm up. You press the button, the car is on, and cabin heat is instantaneous.

- The heated seats and steering wheel make the experience even more luxurious (and reduce the need for cabin heat).

- Remote heating with an in-dash timer or from an app on your phone means your car can be heated and defrosted (or cooled in summer) before you even reach it in your driveway. Without even consuming battery power, if you have the car plugged in.

- Big wheel diameter, low center of gravity and 50/50 weight balance make for better handling and traction.

- Front-wheel drive prevents fish-tailing, and is every bit as safe as all-wheel

drive. Adding snow tires in winter turns the Leaf into a monster snow crusher.



Image via Nissan

People who are on the fence about getting EVs might feel that old issue of range anxiety rising when they hear about reduced ranges in cold weather. However, gas-powered vehicles also have lower fuel efficiency in cold weather. “Fuel economy tests show that, in short-trip city driving, a conventional gasoline car’s gas mileage is about 12% lower at 20°F than it would be at 77°F. It can drop as much as 22% for very short trips (3 to 4 miles).”

So, reduced energy efficiency in cold weather is not only an issue for EVs, but EV critics will probably not mention this fact — or they are not aware enough to mention it.

Most likely, they also will not tell you that Norway is the top country in the world for EV adoption relative to total car sales — of course, it has snowy, icy, cold winters. (The daily mean temperature there in January and February is about 24 degrees Fahrenheit.)

This weather has not stopped Norwegians from driving EVs, with electric car sales starting to reach over 40% of monthly car sales in the country. If EVs didn’t operate well in cold weather, why would there be so many in Norway?

A Model S owner in Norway made a video covering how well his runs in winter, and he said he still has plenty of range.



Here is another Tesla owner talking about taking a trip in -13 Fahrenheit weather.



Do Electric Cars Work in Cold Weather? Get the Facts...



An EV on the slopes of Mt. Hood in Oregon. (Source Oregon Department of Transportation flickr/oregondot)

Excerpted here is another article on winter travel:
By David Reichmuth, Senior Engineer, Clean Vehicles
 In short, yes. All cars (both gasoline and electric) have lower fuel efficiencies at colder temperatures, decreasing how far the vehicle can travel without refueling. However, because some electric vehicles (EVs) have a lower range than the typical gasoline car, these efficiency losses can be an important consideration when choosing an EV in places that have cold winters. Still, today’s EV’s work just fine in cold climates, and new models will be even better.

Read the article at:

<https://blog.ucsusa.org/dave-reichmuth/electric-cars-cold-weather-temperatures>



See the rest of the article and the videos at the URL below:
<https://cleantechnica.com/2018/02/13/electric-vehicles-work-cold-weather/>



A Reuters Analysis of 29 Global Automakers Found That They are Investing at least

\$300 billion

in electric vehicles, with more than 45 percent of that earmarked for China.

By Paul Lienert and Christine Chan

Global automakers are planning an unprecedented level of spending to develop and procure batteries and electric vehicles over the next five to 10 years, with a significant portion of their budgets targeted at China, according to a Reuters analysis of public data released by those companies.

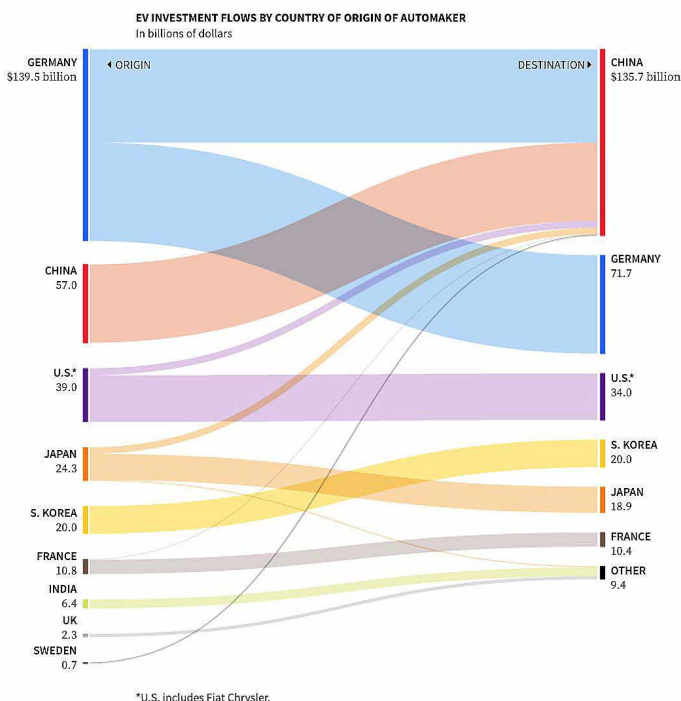
Automakers' plans to spend at least \$300 billion on EVs are driven largely by environmental concerns and government policy, and supported by rapid technological advances that have improved battery cost, range and charging time. The accelerated rate of industry spending — much of it led by Germany's Volkswagen — is greater than the economies of Egypt or Chile.

A significant portion of the global industry's planned EV investment and procurement budget — more than \$135



An electric car charging station is seen at Chinese automaker Geely's booth at the IEEV New Energy Vehicles Exhibition in October 2018. Photo by Thomas Peter

EV INVESTMENT FLOWS BY COUNTRY OF ORIGIN OF AUTOMAKER – In billions of dollars



billion — will be spent in China, which is heavily promoting the production and sale of electric vehicles through a system of government-mandated quotas, credits and incentives. As a result, EV spending by major Chinese automakers from SAIC to Great Wall Motors could be matched or even exceeded by multinational joint-venture partners such as Volkswagen, Daimler and General Motors.

Reuters analyzed investment and procurement budgets made public over the past two years by the automakers, which are based primarily in the United States, China, Japan, South Korea, India, Germany and France. The figures do not reflect planned investments and purchases that have not yet been publicized.

Actual spending by vehicle manufacturers on research and development, engineering, production tooling and procurement likely will be much higher. The analysis also does not include related spending by automotive suppliers, technology companies and large corporations in other industries, from energy and aerospace to electronics and telecommunications.

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A Reuters Analysis of 29 Global Automakers

Volkswagen/Audi/Porsche

Germany

In December 2018, VW said it planned to spend \$34 billion on e-mobility initiatives and \$57 billion on battery procurement through 2025. It plans to introduce 50 battery electric and 30 hybrid electric models by 2025, including 12 electrified models for Audi. Eventually, VW will offer electrified versions of all 300 models in its 12-brand global portfolio, including 15 million vehicles off its dedicated EV platform by 2025. VW will invest \$17 billion by 2022 with China partners SAIC, FAW and JAC to make electrified vehicles.

 TOTAL EV INVESTMENT  BATTERIES ONLY ★ CHINA (PCT OF TOTAL)
\$91 billion **\$57 billion** **\$45.5 billion (50%)**

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals



Toyota

Japan

Toyota is investing \$13.5 billion through 2030 on battery technology. It has a joint venture with Mazda and Denso to develop and build electric vehicles. Toyota plans to launch 10 electrified models in China by 2020, and electrified versions of all models by 2025. It expects to sell 5.5 million electrified vehicles globally by 2030.

 TOTAL EV INVESTMENT  BATTERIES ONLY
\$13.5 billion **\$13.5 billion**

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals



Daimler (Mercedes/Smart)

Germany

Daimler plans to unveil 130 electrified vehicles, including hybrids and fuel cells, by 2030, and has budgeted \$30 billion for batteries. Its Smart brand goes all-electric by 2020, and Daimler is adding electric vans and heavy trucks to its fleet. It is jointly investing \$1.9 billion in China with partner BAIC and is in talks with BJEV to make Smart EVs in China.

 TOTAL EV INVESTMENT  BATTERIES ONLY ★ CHINA (PCT OF TOTAL)
\$42 billion **\$30 billion** **\$21.95 billion (52%)**

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals



Ford

United States

Ford says it will launch 24 new hybrid and 16 new battery electric vehicles by 2022, and says 70 percent of its China vehicles will have electrified powertrain options by 2025. Ford has a \$750 million EV joint venture in China with Zotye.

 TOTAL EV INVESTMENT
\$11 billion

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals



Hyundai/Kia

South Korea

Hyundai and affiliate Kia are investing \$20 billion over five years in electric and self-driving vehicles, as well as batteries. By 2025, the group expects to roll out 14 pure electric vehicles, 12 hybrids and two fuel cell electrics. It is investing \$6.7 billion in fuel cells, and is developing a dedicated EV platform.

 TOTAL EV INVESTMENT
\$20 billion

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals



Fiat Chrysler

Italy/United States

By 2022, FCA's Jeep will offer 10 plug-in hybrids, and four fully electric vehicle models. Maserati will launch eight plug-in hybrids and four full-electric versions by 2022. Alfa Romeo is to electrify its entire lineup, with up to seven plug-in hybrids.

 TOTAL EV INVESTMENT
\$10 billion

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals



Changan

China

Changan plans to end sales of combustion-engine vehicles by 2025, while it launches 21 new electric vehicles and 12 new hybrids by then. Its total electrification budget is \$15 billion.

 TOTAL EV INVESTMENT ★ CHINA (PCT OF TOTAL)
\$15 billion **\$15 billion (100%)**

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals



Nissan

Japan

The Renault-Nissan alliance has a six-year R&D budget of \$20 billion through 2022, and plans to build 17 pure battery-electric vehicles globally by 2022, including eight from Nissan, on common shared platforms. Nissan and partner Dongfeng are jointly investing \$9 billion to build 20 electrified vehicles, including eight pure EVs, in China by 2022. Nissan also is investing \$335 million in an EV and battery plant in Thailand.

 TOTAL EV INVESTMENT ★ CHINA (PCT OF TOTAL)
\$10 billion **\$4.5 billion (45%)**

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals



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A Reuters Analysis of 29 Global Automakers

Renault

France

The Renault-Nissan alliance has a six-year R&D budget of \$20 billion through 2022, and plans to build 17 pure battery-electric vehicles globally by 2022, including nine from Renault, on common shared platforms. Renault has a \$220 million joint venture with Brilliance to build electric commercial vehicles in China.

 TOTAL EV INVESTMENT  CHINA (PCT OF TOTAL)
\$10 billion **\$0.11 billion (1%)**

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals

 Dongfeng  Brilliance  Nissan  Mitsubishi

BMW/Mini

Germany

BMW plans to introduce 12 new battery electric vehicles and 13 plug-in hybrids. It is investing \$340 million in a Leipzig EV plant and \$225 million in a Munich battery plant. BMW is jointly investing \$770 million with partner Great Wall to build Mini EVs in China.

 TOTAL EV INVESTMENT  BATTERIES ONLY  CHINA (PCT OF TOTAL)
\$6.5 billion **\$4.5 billion** **\$0.385 billion (6%)**

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals

 Great Wall  Brilliance  Fiat Chrysler

Tesla

United States

Tesla, which builds only electric vehicles, has budgeted up to \$5 billion for capex for 2019-2020. It has said its new China vehicle and battery plant will cost \$5 billion. Tesla still has not fully funded its \$5 billion Nevada battery factory.

 TOTAL EV INVESTMENT  BATTERIES ONLY  CHINA (PCT OF TOTAL)
\$10 billion **\$5 billion** **\$5 billion (50%)**

GAC

China

GAC is launching 10 electric and hybrid vehicles through 2020. It is partnered with BYD on electric buses, and is building a \$6.5 billion industrial park for EV/AV development and production.

 TOTAL EV INVESTMENT  CHINA (PCT OF TOTAL)
\$6.5 billion **\$6.5 billion (100%)**

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals

 Toyota  Honda  Fiat Chrysler  BYD

General Motors (GM)

United States

GM is planning to roll out 23 new EVs by 2023, and by 2025 it plans to offer electrified versions of nearly all Chevrolet, Buick and Cadillac models sold in China. GM and partner SAIC will jointly build EV battery modules in China. GM also is investing in a new electric vehicle architecture and a new battery system, but has said only that it plans to spend \$8 billion combined on electrification and automation over the next several years.

 TOTAL EV INVESTMENT
\$8 billion

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals

 Honda  SAIC  Wuling  FAW

Anhui Jianghuai Automobile (JAC)

China

JAC has a joint venture to build and sell EVs in China with VW. It also is building vehicles under license for Nio and Ford.

 TOTAL EV INVESTMENT  CHINA (PCT OF TOTAL)
\$6 billion **\$6 billion (100%)**

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals

 Ford  Volkswagen  Nio

Great Wall

China

Great Wall plans to invest as much as \$8 billion over 10 years, to develop hybrid and electric vehicles. It will partner with BMW to build Mini EVs in China.

 TOTAL EV INVESTMENT  CHINA (PCT OF TOTAL)
\$8 billion **\$8 billion (100%)**

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals

 BMW

Mahindra & Mahindra

India

Mahindra's \$5.5 billion investment covers R&D, capacity expansion and development of a dedicated EV platform with affiliate Pininfarina.

 TOTAL EV INVESTMENT
\$5.5 billion

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals

 Ssangyong

continued next page

A Reuters Analysis of 29 Global Automakers

Geely*China*

Geely is investing \$5 billion in a new EV manufacturing center in China. It has a joint venture with Kandi for low-priced EVs.

 TOTAL EV INVESTMENT  CHINA (PCT OF TOTAL)
\$5 billion **\$5 billion (100%)**

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals

BAIC*China*

BAIC plans to end sales of combustion-engine vehicles by 2025. It sells electric vehicles through its BJEV affiliate. BAIC is jointly investing \$1.9 billion with Daimler in EV development, while affiliate BJEV is investing \$1.5 billion to produce 500,000 EVs a year through 2022.

 TOTAL EV INVESTMENT  CHINA (PCT OF TOTAL)
\$2.45 billion **\$2.45 billion (100%)**

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals

SAIC*China*

SAIC is spending \$3.8 billion through 2020 on electric and hybrid vehicle development, including joint development of EVs and batteries with partner GM. In addition, SAIC is jointly investing \$2.45 billion with partner VW in a new EV plant in China.

 TOTAL EV INVESTMENT  CHINA (PCT OF TOTAL)
\$5 billion **\$5 billion (100%)**

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals

Jaguar Land Rover*United Kingdom*

Jaguar Land Rover, a unit of India's Tata, is planning to offer electrified versions of all its vehicles by 2020.

 TOTAL EV INVESTMENT
\$2.34 billion

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals

Dongfeng*China*

Dongfeng will begin EV production in 2019 in partnership with Renault Nissan. DFM is planning to introduce 40 electrified vehicles by 2023.

 TOTAL EV INVESTMENT  CHINA (PCT OF TOTAL)
\$4.5 billion **\$4.5 billion (100%)**

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals

Tata*India*

Tata is working with UK affiliate Jaguar Land Rover to develop future EVs and hybrids.

 TOTAL EV INVESTMENT
\$0.9 billion

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals



BYD*China*

BYD is spending \$3 billion to quadruple EV battery production capacity in China. BYD and partner Daimler are increasing investment in their Denza electric vehicle venture by \$60 million each. BYD is building electric trucks with GAC.

 TOTAL EV INVESTMENT  BATTERIES ONLY  CHINA (PCT OF TOTAL)
\$3.86 billion **\$3.8 billion** **\$3.86 billion (100%)**

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals

PSA Peugeot Citroen*France*

Peugeot Citroen will launch 40 new electrified vehicles by 2025, including four pure electric models built on a dedicated EV platform. It has a \$520 million joint venture with Changan to build EVs in China, and is investing \$250 million to build EV motors.

 TOTAL EV INVESTMENT  CHINA (PCT OF TOTAL)
\$0.77 billion **\$0.26 billion (34%)**

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals

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A Reuters Analysis of 29 Global Automakers

Volvo

Sweden

Volvo Cars, a unit of China's Geely, will offer electrification options across its entire range by 2020, and is introducing five new all-electric models by 2021. Volvo is investing \$725 million in its Polestar EV brand in China.

TOTAL EV INVESTMENT ★ CHINA (PCT OF TOTAL)
\$0.725 billion **\$0.725 billion (100%)**

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals



FAW

China

FAW established a joint venture with Audi in early 2017 to develop and build China Evs. FAW is jointly developing hybrids with Toyota, and has invested \$250 million in EV startup Byton. FAW's premium Hongqi brand will unveil 15 new electric vehicles by 2025.

TOTAL EV INVESTMENT ★ CHINA (PCT OF TOTAL)
\$0.25 billion **\$0.25 billion (100%)**

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals



Honda

Japan

Honda plans to make its global portfolio two-thirds 'electrified' by 2030. It will buy EV batteries from GM. Honda is investing \$180 million in an EV/battery plant in Thailand and another \$130 million in India. It is jointly building a \$470 million EV plant in China with partner GAC.

TOTAL EV INVESTMENT ★ CHINA (PCT OF TOTAL)
\$0.545 billion **\$0.235 billion (43%)**

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals



Mazda

Japan

Mazda aims to sell only hybrids and battery electric vehicles by 2030.

TOTAL EV INVESTMENT
\$0.25 billion

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals



Correction: A previous version of this graphic incorrectly labeled GM as a German automaker under the SAIC description. GM is an American automaker.
 Additional work by Ashlyn Still
 Editing by Ed Tobin
 REUTERS GRAPHICS

Chery

China

Chery's future electric and hybrid models will be built on a new dedicated platform and sold under the Exeed brand.

TOTAL EV INVESTMENT ★ CHINA (PCT OF TOTAL)
\$0.435 billion **\$0.435 billion (100%)**

AFFILIATIONS

Joint ventures, partnerships, investments, licensing agreements and purchasing deals



<https://graphics.reuters.com/AUTOS-INVESTMENT-ELECTRIC/010081ZB3HD/index.html>



Daimler Delivers First Fully Electric Freightliner eM2



With the delivery of the first all-electric Freightliner eM2 to Penske Truck Leasing, Daimler Trucks has now also launched practical tests for heavy and medium-heavy electric trucks in the USA. In future, Penske Truck Leasing will use the electric truck in local distribution traffic in the northwest of the USA and in California.



[Read the rest of the article at the URL below.]

<https://www.electrive.com/2019/01/03/daimler-delivers-first-fully-electric-freightliner-em2/>

Here Are the Electric Car Models Coming in 2019



2019 Audi e-tron first drive - Abu Dhabi UAE, December 2018

By Eric C. Evarts from *Green Car Reports*

Regular readers of *Green Car Reports* know it has been reporting for a year now that 2019 is the year of the electric SUV. [Ed.: We thought we would share a peek at what they know about all the upcoming models.] Most are SUVs, with a couple of hatchbacks thrown in. In many cases their specific arrival dates are not made public, but we've estimated as closely as we can based on statements by the automakers.

2019 Hyundai Kona Electric

The Hyundai Kona Electric should be going on sale any day and is one of the most promising electric cars of 2019. With a rating of 258 miles of range, it was a finalist in Green Car Reports' Best Car to Buy competition for 2019. Its small-crossover format gives ample space inside and a good view out. With only front-wheel drive available, some may consider it a car, rather than an SUV. Hyundai has said that it will start at \$37,495.



2019 Hyundai Kona Electric

2019 Kia Niro EV

The Kia Niro EV is related to the Hyundai Kona Electric from Kia's sister company. The pair uses the same 64-kWh battery, and the Niro EV is expected to have 239 miles of range, a little less than its corporate sibling. It will be the first all-electric version of Kia's dedicated green car: the Niro Hybrid went on sale in 2017 and the Niro Plug-In Hybrid in 2018. Kia has not announced pricing but the Niro EV is expected to go on sale in February.



2019 Hyundai Kona Electric

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2019 EVs

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2019 Nissan LEAF long range

Perhaps the biggest news in affordable electric cars is that the original modern electric, the Nissan LEAF, will finally move into the age of long-range electric cars. While Nissan never intended the LEAF to be a compliance car, the original model was rated at just 73 miles of range. Despite a few improvements over the years, the new model introduced in 2017 could only go 151 miles—better than anything but a Tesla at the time, but still short of what many drivers wish for.

The long-range LEAF will have a 60-kilowatt-hour battery made by Korean conglomerate LG, which is expected to carry it about 220 miles. Dealer pricing guides have shown its cost will land right in line with the longer, 238-mile, Chevy Bolt EV. It is expected to go on sale in the spring and to debut next week at the Consumer Electronics Show in Las Vegas.



2018 Nissan LEAF long range

2019 Audi e-tron quattro

The Audi e-tron quattro is a five-passenger SUV, with a range expected to be just short of its 248-mile European (WLTP) estimate from a 95-kWh pack, and a price tag starting at \$75,795. That puts it about \$9,000 less than a Tesla Model X—and like all the other cars on this list, it will also be eligible for the full \$7,500 federal tax credit, while Teslas will earn only \$3,750 now, or \$1,875 after July 1. The e-tron quattro will be the first electric vehicle capable of charging at 150 kilowatts, about 25 percent faster than Teslas, at one of a handful of such fast chargers being installed around the country. Charging networks such as ChargePoint, EVgo, and Electrify America, however, are expanding such charger installations.



2019 Audi e-tron quattro, in European trim, at San Francisco launch event

2020 Mercedes-Benz EQC

The Audi e-tron quattro is expected to be followed by the similar 2020 Mercedes-Benz EQC, which will be built in the U.S. at Mercedes' factory in Alabama. The car will go on sale in Europe this spring, but will take between six months and a year to make it to the U.S. En route, it needs to pick up more range. When it was introduced in Europe, the company said it would have 200 miles of range on the relatively generous European efficiency test, which would not make it competitive in the U.S. against the e-tron, the Tesla Model X, or even the much cheaper Hyundai Kona Electric. It's not clear whether Mercedes plans to expand the battery pack to bring the car to the U.S. or to improve its efficiency.



2020 Mercedes-Benz EQC

continued next page

2020 Kia Soul EV

Kia is giving its hamster-cute little Soul hatchback a complete redesign for 2020, including its electric version. With the same big, 64-kWh battery as the larger Kia Niro EV, it will deliver a dramatic range improvement over the outgoing Soul EV. The new model is even likely to improve on the range of the Niro EV, at least in the city, with same battery in a smaller, lighter package. **It will switch from CHAdeMO fast charging to a new CCS Combo fast-charge port.** The Soul EV will arrive several months after the Niro EV.



2020 Kia Soul EV

2019 Volkswagen ID

Late this year, Volkswagen is expected to launch the long-awaited first electric vehicle from its eponymous brand, the Golf-size ID hatchback. There's only one catch: It will only be sold in Europe and won't make it to the U.S. It will, however, be the first car based on the new MEB electric architecture that VW is planning to underpin as many as 27 new all-electric models, many of which are aimed squarely at U.S. buyers, including the 2020 ID Crozz and the 2022 electric revival of the classic microbus. Base models will probably get a 48-kWh battery, which should give them a range of about 200 miles, though VW hasn't released precise specifications. Pre-orders are expected to start in March.



2019 Volkswagen ID Neo spy Shots

2020 Porsche Taycan

Based on early deposits, the Porsche Taycan could be Tesla's chief competitor. With 300 miles of range and up to 600 horsepower, the Taycan offers the performance of a Model S P100D. It will also be the first mass-produced electric car with an 800-volt battery system that can receive a 240-mile charge in about 10 minutes. After it goes on sale late in the year, Porsche will offer three versions: a base model, a 4S and what could be called a "Turbo," starting at about \$90,000 and running up through more than \$130,000.



Porsche Mission E concept electric car

2020 Polestar 2

Volvo's upcoming high performance brand, Polestar plans to follow up its first model, a hybrid coupe, with an all-electric five-door hatchback, based on the Volvo XC40—which is a taller, crossover five-door hatch. Put the two together, and it could resemble something like the Volvo 40.2 concept that the brand showed in 2016. It could arrive as early as the end of the year.



Volvo 40.2 concept

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2019 EVs

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2020 Mini Electric

One of the first modern electric cars on the market was the Mini-E, a Mini Cooper converted to electric power in small numbers to serve as a test-bed for BMW's electric car programs. [Ed. i.e., post-California ZEV mandate reversal] In the coming year, Mini plans to reintroduce the car as the fully-fledged Mini Electric, complete with its back seat, rather than a bank of batteries that take up the whole rear passenger compartment. The company showed a concept car at the Frankfurt auto show in 2017, and has announced plans to build a giant battery construction facility in Germany to supply several vehicles, including this one and the upcoming BMW iX3 electric SUV.



Mini Electric concept, 2017 Frankfurt auto show

2020 BMW iX3

Another possible contender to arrive in 2019 could be the BMW iX3, which the company has said it will build in China for worldwide markets starting late this year. Based on the current X3 SUV, the iX3 is expected to have a 70-kWh battery pack and deliver a range of 250 miles. Like its chief competitor, the Audi e-tron quattro, it is expected to be configured to accept a 150-kw DC fast charge.



BMW iX3 Concept front 3/4

2020 Ford "not Mach 1" SUV

Ford is also working on a 300-mile electric SUV for 2020, and this model could be fully revealed by the end of 2019. [Ed. recent announcements of joint Ford- VW development efforts give credence to this statement.] Designed to look like a Mustang and deliver off-road performance on par with the F-150 Raptor pickup, the unnamed SUV will be Ford's first dedicated electric model, though the brand has released scant details otherwise.



2020 Ford electric SUV teaser

https://www.greencarreports.com/news/1120745_here-are-the-electric-car-models-on-the-way-for-2019

DID YOU KNOW?

The Chevy Bolt uses 288 prismatic cells in its 60 kWh battery pack. The Nissan LEAF uses 192 pouch cells, while Tesla packs require lots of cells. A 50 kWh battery in the Model 3 has 2,976 cylindrical cells, a 100 kWh Model S or X pack fits 8,256, and the 90 kWh one uses 7,104).

Clearly different cells provide different results.

Tesla Delivers 90,700 Vehicles in Q4 of 2018



By Chris Randall

Tesla has released its production and delivery numbers for the fourth quarter of 2018. According to their numbers, 86,555 electric vehicles were manufactured, and 90,700 vehicles were delivered.

Of the 86,555 vehicles produced in the last quarter, Model 3 accounted for the lion's share with 61,394 units, while 25,161 Model S and Model X were produced. That 90,700 vehicles were delivered means that Tesla has delivered eight per cent more than in Q3/2018, which was itself a record quarter. These included 63,150 Model 3 (an increase of 13 per cent compared to the third quarter of 2018), 13,500 Model S and 14,050 Model X. A further 1,010 Model 3 and 1,897 Model S and Model X were still in transit at the end of the fourth quarter of 2018 and will be delivered at the beginning of the first quarter of 2019.

Looking at the entire year, Tesla managed to deliver a total of 245,240 electric vehicles. In detail, this was 145,846 Model 3, and 99,394 Model S & Model X vehicles. This means that

the company managed to deliver as many vehicles last year, as all previous years combined.

To date, the delivery of the two variants Model 3 “Mid Range” and “Long Range” has been limited to North American customers. More than three-quarters of Model 3 orders in the fourth quarter came from new customers and not from reservation holders. Deliveries in Europe and China will start in February 2019, as is well known. In Europe before Christmas, the Californian company opened the configurator for binding orders for the Tesla Model 3 to those with pre-orders. For the time being, however, only the “Long Range” version is available in Europe. In Germany, this version starts at 55,400 Euro.

Tesla is also reducing the prices of all its models in the USA by 2,000 dollars with immediate effect, in order to partially cushion the effect of the halving of US tax subsidies from 7,500 to 3,750 dollars for Tesla EVs, which came into force on January 1.

<https://www.electrive.com/2019/01/02/tesla-delivers-90700-vehicles-in-q4-of-2018/>



Can a non-Tesla EV make it without the Tesla Supercharging network?

In this video the creator discusses how cross country travel by EV without the Tesla SuperCharging network might be done. This would be of interest to potential owners of new owners of Bolt-EVs, as well as Porsche, Jaguar, Audi and others, as of this month.

https://www.youtube.com/watch?v=wRQfZ9i_Q0I

Tesla Model 3 Cost Surprised Porsche and Audi After Reverse-Engineering



By Fred Lambert

Tesla Model 3 is now entering the European market and it is making some automakers nervous. According to a new report, Porsche and Audi reverse-engineered Tesla's new electric car and they were quite surprised by its cost.

It's somewhat common in the industry to purchase vehicles from competitor to see what they are up to, but it also becomes a necessity for vehicles that are seen as important disrupters.

The Model 3 appears to fit the description as it apparently outsold all other premium sedans combined in the US.

During the early production ramp up, it was difficult to get your hands on a Model 3, but some automakers paid a pretty penny to be amongst the first to be able to check out the new electric car.

About a year ago, two Model 3 vehicles were spotted on their way to Germany – presumably to be reverse-engineered.

Later, a report came out about a German automaker being impressed by Model 3 after reverse-engineering it.

Now a new report from Germany's *Manager Magazin* <http://www.manager-magazin.de/premium/audi-bram-schot-will-tempo-machen-a-00000000-0002-0001-0000-000161978234>

(German and paywall) includes a deep dive into the state of Audi with comments from executives and insider sources.

It claims that Porsche and Audi, who are working together on a next-generation electric platform, had to change their approach because the cost was too high compared to what Tesla is achieving.

They report:

"The Porsche and Audi engineers have to change [the PPE] because Tesla's Model 3 has gotten better than they thought."



Audi-Chief Bram Schot
Photo: manager-magazin.de

The next-gen platform called Premium Platform Electric (PPE) was greenlighted almost two years ago and it is expected to be ready around 2020 or 2021.

<https://electrek.co/2017/04/05/porsche-audi-electric-autonomous-vehicles/>

According to the new report, the first version was coming at about 3,000 euros too expensive, which Porsche is said to be able to absorb but Audi wasn't on board. They believe that they need to lower the cost in order to be competitive with other upcoming EVs.

continued next page

The battery cell cost is apparently the biggest factor that pushes the cost of the platform higher and Tesla claims to be leading the industry on that front.

According to the report, Audi and Porsche could delay the PPE in order to improve the cost and be competitive with Tesla.

The PPE is becoming increasingly important for Audi according to Manager-Magazin's report, which describes a failing e-tron program:

The e-tron as the first electric Audi is not only late. It does not reach some target values and has become far too expensive with more than two billion euros in development costs. The approximately 600,000 cars sold for the break-even are now regarded as an illusion.

The e-tron electric SUV was supposed to be delivered to customers last year, but Audi says that software issues have resulted in delays.



Green Car Reports: e-tron electric SUV

<https://electrek.co/2019/02/09/tesla-model-3-cost-surprise-porsche-audi-reverse-engineering/>

The German automaker is still planning several other vehicles based on the same platform before the PPE becomes available.

Electrek's Take

We often hear complaints about Tesla not yet delivering on the base \$35,000 version of the Model 3, which I think is fair, but we still need to acknowledge that Tesla is the only automaker currently mass producing a compelling long-range EV and doing it profitably.

I think that's what is impressing Audi and Porsche here and what they wish to emulate with the PPE platform.

A decade from now, I think we will not only look back at Model 3 for how the vehicle program accelerated EV adoption through volume but also for the impact it had on other automakers.

The fact that they were apparently 3,000 euros behind for a platform coming in another two years just shows how Tesla is far ahead.

As for the e-tron program, the report is worrying. I've been cutting Audi some slack over the delays for the e-tron SUV, but I'd like to see some volume soon.

We hear that the launch in the US is still planned for Q2 2019.



Tesla Sentry Mode Review and More



This short video review of the latest Tesla over the air (OTA) software update covers the new features including "Sentry Mode". Once enabled, it can detect and record video while sending SMS notification to your smartphone. This is the first factory response to increasing numbers of break-in crimes (smash and grab incidents) in the Bay Area.

Also included is Dog mode, to maintain temperatures in the car with a screen advising outsiders of the facts.

These will be improved upon over time (as bugs are discussed). It is another free, post-delivery enhancement for owners of the S, X and 3 vehicles equipped with cameras.



<https://www.youtube.com/watch?v=7Hfu0msl6WI>

AirSpaceX's Autonomous, Electric Air Taxi Lands in Detroit

By David Szondy

Airspace Experience Technologies, LLC (AirSpaceX) has given a preview of its vision for the future of air taxi services at this year's North American International Auto Show (NAIAS). The company unveiled a sub-scale model of its vertical take off and landing (VTOL) aircraft, Mobi-One, an autonomous, tilt-wing electric aircraft designed to carry both passengers and cargo at speeds of up to 250 mph (400 km/h).

According to AirSpaceX, US\$300 billion dollars in fuel and productivity costs a year are wasted in traffic jams and other delays in the US alone. Additionally, urban drivers spend 42 hours stuck in traffic each year, while pumping 38 billion pounds (17 billion kg) of carbon emissions into the atmosphere.

Designed and built by AirSpaceX parent company Detroit Aircraft Corporation (DAC) at Detroit City Airport, Mobi-One is targeted at the point-to-point commuter market as a clean, quiet alternative to road transport that relies on "lean automotive design and mass production techniques" to be affordable to produce.

Mobi-One uses four wing-mounted electric motors that the maker claims makes the aircraft quieter than a helicopter. It's designed to carry two to four passengers or payloads of over 200 kg (440 lb) at a cruising speed of 150 mph (241 km/h) over a range of 65 mi (104 km).

Along with its pilot assisted/autonomous flight avionics, it also has broadband connectivity for high speed internet access, V2X collision avoidance, and safety messaging. Aside from passenger



Mobi-One is designed to ease traffic congestion and speed up urban commutes (Credit: AirSpaceX)



Mobi-One is powered by four electric motors (Credit: AirSpaceX)



Mobi-One has an autonomous flight system (Credit: AirSpaceX)

and cargo services, it can also be used for medical and casualty evacuation; tactical Intelligence, Surveillance, and Reconnaissance (ISR); and research flights.

The Mobi-One was developed in cooperation with Camilo Pardo, who was the chief designer of the 2005 and 2006 Ford GT. Completion of the aircraft's engineering packages are still the primary focus, but the hope is that a

full-scale version of the craft will soon be available for US FAA certification.

"Our goal is to deploy 2,500 aircraft at the nation's 50 largest cities by 2026, targeting existing infrastructure at first," says JP Yorro, Chief Commercial Officer at AirSpaceX. "The MOBi development program will be capital intensive, but air Mobility as a Service could generate billions for the economy." Source: AirSpaceX

<https://newatlas.com/airspacex-mobi-one-detroit/52985/>

Boeing Completes First Test Flight for Electric Passenger Craft Prototype



By Dacia J. Farris

Boeing's electric passenger air vehicle (PAV) prototype successfully completed its first test flight in Manassas, Virginia, marking a milestone in the aerospace giant's march toward fully autonomous electric flight. The craft is more broadly part of Boeing's NeXt program dedicated to urban mobility efforts and was designed by Boeing subsidiary Aurora Flight Sciences for Uber Air's flying taxi service which looks to begin ferrying passengers as early as 2023.

The successful test flight, achieved after one year from conceptual design to flying prototype, demonstrates Boeing's commitment to being a significant presence in the air taxi market.

The yet-unnamed PAV is battery-powered and will be capable of fully autonomous flight with a range of up to 50 miles. Its current dimensions are 30 feet long and 28 feet wide, making it slightly more compact than the average private pilot craft, and it boasts an advanced airframe design integrating four rotors and wings. It should be noted that the test flight only comprised

a controlled takeoff, hover, and landing, meaning the most challenging phases for vertical take-off and landing (VTOL) aircraft are yet to be tested – regular flight and transitioning from hovering to forward propulsion.

A similar and impressive air taxi prototype was on display at this year's Consumer Electronics Show in Las Vegas – the Bell Nexus, whose corporate designer and owner, Bell Helicopter by Textron Inc., is another partner with Uber Air. Also a VTOL aircraft, the Nexus is a hybrid-electric with six rotors that tilt 90 degrees, a Safran turbine for propulsion, and seats four passengers plus a pilot. Bell's experience with the V-22 Osprey, a half plane, half helicopter aircraft used by the US military, makes the company a natural fit for VTOL civilian solutions.

Given the rapid pace of development in urban air transport technology thus far, future delays in launching the Uber Air service may be due to regulatory hurdles. The Federal Aviation Administration (FAA) has only begun

looking at significantly loosening consumer drone regulations this year. Given the safety issue differences between small hobby crafts and those the size of automobiles, governmental hesitation certainly seems inevitable.

The legal challenges that will come with commercial air taxis are something Boeing NeXt has made part of its planning efforts, and the company is working with regulatory agencies and industry partners to find pathways to market for consumer air mobility technologies. As an aviation industry giant, Boeing's long-standing involvement in the arena will likely come as a helpful tool in this effort. Boeing's Chief Technology Officer, Greg Hyslop, commented on the PAC's development in the company's press release announcing the test flight: "Boeing's expertise and innovation have been critical in developing aviation as the world's safest and most efficient form of transportation, and we will continue to lead with a safe, innovative and responsible approach to new mobility solutions."

<https://www.teslarati.com/boeing-electric-passenger-craft-test-flight/>

Keep Up on all Auto Shows & EV Related Conferences

US and International Events

PITTSBURGH INTERNATIONAL AUTO SHOW 02/15/19 - 02/18/19

AUTORAMA-DETROIT, MICHIGAN
03/01 - 03/03/19

89TH GENEVA SWITZERLAND INTERNATIONAL MOTOR SHOW
03/07-03/17/19

SILICON VALLEY INTERNATIONAL AUTO SHOW SAN JOSÉ
03/07-03/10/19

GREATER KANSAS CITY INTERNATIONAL AUTO SHOW 03/06-03/10/19

AMELIA ISLAND CONCOURS D'ELEGANCE 03/08/19 - 03/10/19

OKC AUTO SHOW 03/08/19 - 03/10/19

WORLD OF WHEELS-CHICAGO
03/08/19 - 03/10/19

WORLD OF WHEELS-OMAHA
03/15-03/17/19

AUTOMOTIVE DIAGNOSTICS MUNICH, GERMANY 03/19-03/20/19

NORDIC EV SUMMIT 2019, OSLO NORWAY 03/21-03/22/19

ATLANTA INTERNATIONAL AUTO SHOW
03/20-03/24/19

WORLD OF WHEELS-BOSTON (WW)
03/22-03/24/19

MID-AMERICA TRUCKING SHOW (MATS) LOUISVILLE
03/28-03/30/19

DENVER INTERNATIONAL AUTO SHOW
03/27-03/31/19

EVERYTHING EV - LONDON, ENGLAND
04/02/19 - 04/03/19

WASHINGTON AUTO SHOW
04/05/19 - 04/14/19

NEW MEXICO INTERNATIONAL AUTO SHOW 04/05/19 - 04/07/19

ELECTRIC VEHICLES: EVERYTHING IS CHANGING 2019 BERLIN, GERMANY
04/10/19 - 04/11/19

FORMULA E: ROME E-PRIX
ROME, ITALY 04/13/19

TULSA, OKLAHOMA AUTO SHOW
04/12/19 - 04/14/19

All the Information You Need, in One Place! EVERYTHING EV - LONDON April 2&3 2019

<https://www.solarenergyevents.com/resources/list/category/everything-ev>

Video of Interest

The reason Tesla bought Maxwell Technologies for \$218m

Maxwell Technologies – At a Glance



In this technology summary of Tesla's recent acquisition of Maxwell Technologies, the author presents good research where many details emerge. Maxwell is pushing their Dry Battery Electrode tech, which they have been working on several years. This partnership was hinted at during the CEO presentation at a 16 January Needham Growth conference in NY. That audio is inserted and is quite revealing. There is much speculation, financial posturing, and discussion of the advantage of using these electrodes. It could save production floor space and costs impacting their Gigafactory operation energy consumption, as compared to today's wet electrodes.

Where will this lead to? What will Tesla do with it - improvements in PowerWall / PowerPack, or lighter vehicles? Time will tell. This is an interesting development, to say the least.

<https://youtu.be/fE97Mj7Cmzk>

Articles of Interest

GreenPower Announces the Launch of the EV Star CarGO Van

All-electric Vehicle with a Payload of up to 6,000 Pounds and Capacity of 570 Cubic Feet

GreenPower Motor Company Inc. announces the launch of the EV Star CarGO Van, an all-electric, zero emission, 25-foot cargo van with capacity of over 570 cubic feet, a payload of up to 6,000 pounds, and an operational range of up to 150 miles on a single charge. The EV Star CarGO Van can be configured with either a Level 2 or a CCS DC Fast charge system.

“The EV Star Cargo Van has all the payload and versatility of a standard gas or diesel cargo van but costs less to operate and generates zero emissions,” said Brendan Riley, President of GreenPower.



“The EV Star CarGO is a rugged vehicle that serves a wide range of end markets and is a great choice for technicians, the food services industry, cargo transport and any other local organizations with a mandate to reduce emissions.”

About GreenPower Motor Co. Inc.

GreenPower designs, builds and dis-

tributes a full suite of high-floor and low-floor vehicles, including transit buses, school buses, shuttles, and a double decker. GreenPower employs a clean-sheet design to manufacture all-electric buses that are purpose built to be battery powered with zero emissions. GreenPower integrates global suppliers for key components, such as Siemens or TM4 for the drive motors,

Knorr for the brakes, ZF for the axles and Parker for the dash and control systems. This OEM platform allows GreenPower to meet the specifications of various operators while providing standard parts for ease of maintenance and accessibility for warranty requirements. For further information go to:

<http://www.greenpowerbus.com>

Photo: Green Power Motor Co.

<https://globenewswire.com/news-release/2019/02/13/1724719/0/en/GreenPower-Announces-the-Launch-of-the-EV-Star-CarGO-Van.html>

A look at Level 3 Autonomous Driving, as experienced at German Bosch test track



Equipped with six radar units, six Lidar units, camera's watching the driver, additional lights on the steering wheel, and a whole new suite of software not normally seen on a Tesla Model 'S', this nearly seven minute video taken at Bosch's German test facility shows what Level 3 autonomous driving technology has in store for us. The driver (technician) gets carried away in an informative explanation, but the system notices, complaining that his eyes are not on the road! Called "gaze tracking", it's rather spooky, but exciting at the same time. (Remember you can turn on closed captions if necessary to understand the spoken dialog.)

<https://www.dailymotion.com/video/x5tzj3g>

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.

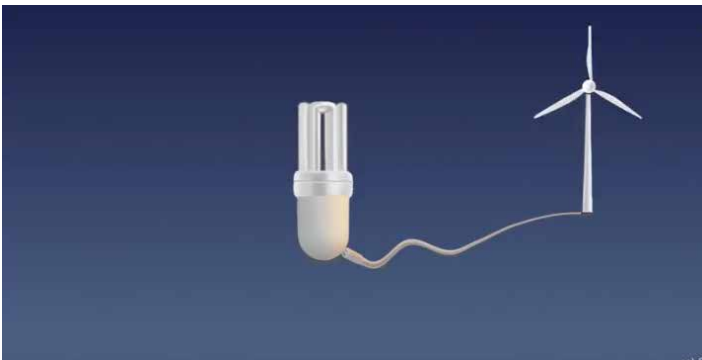
Videos of Interest

Tesla Autopilot in Heavy LA Traffic



This short video shows how autopilot functions in a Tesla Model 3. The audio portion is very informative and one can clearly see it working, what the driver has to do, etc. Using software version 9 (2018.48.12) with navigate on Autopilot in heavy highway traffic, showing merging and lane changing in moderately heavy highway traffic. Autopilot performs well when there are about two or more car-lengths between vehicles, but can swerve unnaturally when aborting an automatic lane change. Watch and judge for yourself.
<https://youtu.be/m3-QzTFxoUg>

Solid State Batteries - has Goodenough nailed it again??



Looking ahead into the misty fuzzy future — we see that Solid State Batteries potentially offer a step up in our EV capabilities. They are smaller, lighter, safer, and pack more energy in for longer range, plus they don't use cobalt! When will we see them in cars? Researchers worldwide are racing develop a product to bring to market, and one contender is the world's most unsung hero: John B. Goodenough — creator of the original Lithium Ion Battery. This short video provides an overview with some humor.
<https://youtu.be/ifLxkO0w6B4>

Electric Cars Myths vs Facts



Author Matt Ferrell dives into some of the most common arguments he has heard about why electric vehicles are bad. Things like taking too long to charge, batteries not lasting, not being as clean as you think and being worse for CO₂ emissions, and not enough range. We highly recommend watching this all the way thru, but if you want to recall particular point, he has prepared timestamps for easier review. Share this with your chapters and everyone you encounter who is considering an EV as a next car! This is the URL.
<https://www.youtube.com/watch?v=kk7ZTn9g7bY>

Too long to charge: 0:14 Can't drive in a blackout: 3:15
 Batteries don't last: 4:07 EVs aren't as clean as you think: 5:48
 Not enough range: 8:55 EVs are too expensive: 10:40
 Fire hazard: 13:03 Final thoughts: 14:49

All of his citations are included in his write up here:

<https://undecidedmf.com/episodes/2019/1/1/electric-cars-myths-vs-facts>

VW ID. First Drive | Fully Charged



Robert travels to South Africa to get a "first drive" opportunity of the VW ID which will become available in Europe in 2020. Some characteristics are immediately discernible, such as the streamlined front shape. However, no images of the dash nor interior are included, just an interesting discussion with a representative from VW, concerning the various design aspects which include rear wheel drive, extensive modularization, and a 500 km projected WLTP range (about 310 miles). That represents the Worldwide Harmonised Light Vehicle Test Procedure (WLTP) laboratory tests specifying conditions defined by EU law for fuel economy and CO₂ measurements.

<https://www.youtube.com/watch?v=SHLLyQ4yIq4>

Don't Miss These Articles of Interest (cont.)

Rivian CEO Talks Auxiliary Batteries and 'Jurassic Park' Style Self-driving Tours

By Simon Alvarez

As Rivian continues to set the stage for the production of its first two vehicles — the R1T pickup truck and the R1S SUV — CEO RJ Scaringe has started dropping some compelling new details about the two upcoming all-electric outdoor adventure vehicles. In a recent interview, the 35-year-old CEO mentioned a couple of upcoming features for the R1S and the R1T, such as an auxiliary battery that acts like a “digital jerry can” and autonomous capabilities that echo some iconic scenes from Hollywood.

Scaringe's recent statements were related in an interview with Tesla owner-enthusiast Sean Mitchell of All Things EV. During the interview, the Rivian CEO and the longtime electric car owner talked about the R1T and the R1S' batteries, their autonomous features, and even their charging infrastructure. Needless to say, it appears that the startup electric car maker has a number of compelling announcements in the pipeline.

A particularly compelling detail related by Scaringe involved the R1T and the R1S's batteries. Being luxury adventure vehicles, the pickup truck and SUV are designed to go on long trips and travel off the beaten path without running out of range. As noted by the Rivian CEO, range is the primary reason behind the company's extra large battery packs, which are offered at 105 kWh, 135 kWh, and 180 kWh configurations. With its largest battery pack, the Rivian R1T and R1S are expected to be capable of traveling more than 400 miles per charge.

To further avoid any range anxiety, Scaringe added that Rivian is currently working to install chargers at notable outdoor adventure locations, such as national parks and ski resorts. In the event that extra range is needed on the go, the CEO revealed that Rivian is also working on creating auxiliary batteries that work like a portable, extra tank of fuel which could provide the R1S and the R1T with extra range to make it to a charging station.

During the vehicle's unveiling, Rivian noted that its vehicles would feature autonomous capabilities. To enable this, both the R1S and the R1T are equipped with a suite of cameras, radar, ultrasonic sensors, high-precision GPS technologies,

and two, cleverly-placed LiDAR. Scaringe described some of Rivian's upcoming autonomous features, including a self-driving tour function reminiscent of the iconic SUVs in the classic Steven Spielberg film Jurassic Park.

“Let's say you are in a national park. We can give you a guided tour of that park, you know, narrated and explaining what you're seeing, but it's like the vehicles are on “digital rails,” sort of Jurassic Park style, as it drives around the park. These are some of the features we're gonna be showing over the course of next year,” Scaringe said.

Both the Rivian R1T and R1S are designed to be just as capable in rough terrain as they are on paved roads. Thanks to their heavy battery packs, Scaringe noted that both vehicles actually have a low center of gravity despite their high ground clearance. This also gives the pickup truck and SUV stability and impeccable handling. The four electric motors used in the R1T and R1S provide the cars with some impressive performance specs as well, such as a 0-60 mph time of 3.0 seconds for the 135 kWh variant. Rivian has opened its pickup truck and SUV for reservations, with production expected to start at 2020.

Watch Rivian CEO RJ Scaringe's recent interview with Sean Mitchell in the video below.

Aspen gondola chat with Rivian CEO RJ Scaringe



<https://youtu.be/TCLb8AoOIQE>

<https://www.teslarati.com/rivian-ceo-auxiliary-batteries-jurassic-park-style-self-driving-tours-digital-rails/>



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movie

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Carbon Capture System Turns CO₂ Into Electricity and Hydrogen Fuel

By Michael Irving

If we're going to reach the goal of keeping Earth from warming more than 1.5° C (2.7° F) this century, it's not enough to just reduce our carbon dioxide emissions – we need to actively clean it out of the atmosphere too. Inspired by the ocean's role as a natural carbon sink, researchers at Ulsan National Institute of Science and Technology (UNIST) and Georgia Tech have developed a new system that absorbs CO₂ and produces electricity and useable hydrogen fuel.

The new device, which the team calls a Hybrid Na-CO₂ System, is basically a big liquid battery. A sodium metal anode is placed in an organic electrolyte, while the cathode is contained in an aqueous solution. The two liquids are separated by a sodium Super Ionic Conductor (NASICON) membrane.

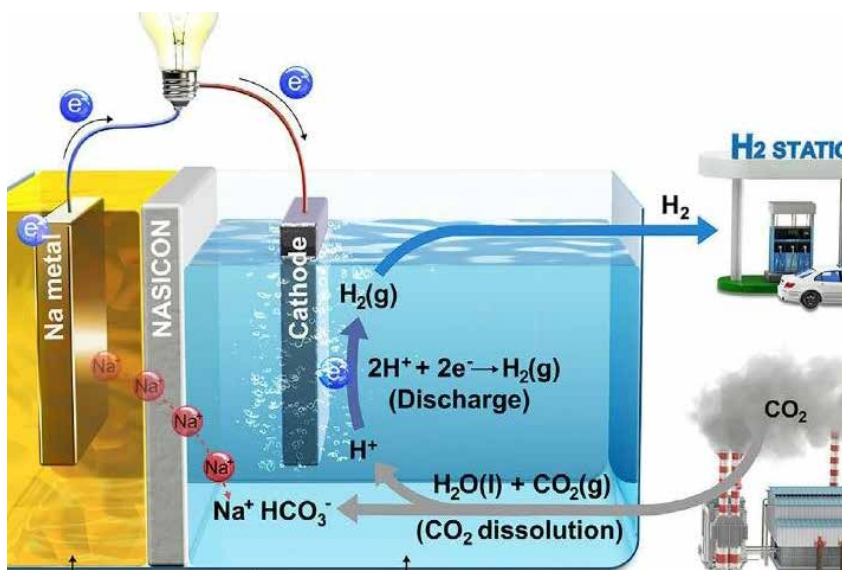
When CO₂ is injected into the aqueous electrolyte, it reacts with the cathode, turning the solution more acidic, which in turn generates electricity and creates hydrogen. In tests, the team reported a CO₂ conversion efficiency of 50 percent, and the system was stable enough to run for over 1,000 hours without causing any damage to the electrodes. Unlike other designs, it doesn't release any CO₂ as a gas during normal operation – instead, the remaining half of the CO₂ was recovered from the electrolyte as plain old baking soda.

“Carbon capture, utilization, and sequestration (CCUS) technologies have recently received a great deal of attention for providing a pathway in dealing with global climate change,” says Professor Guntae Kim, lead researcher on the study. “The key to that technology is the easy conversion of chemically stable CO₂ molecules to other materials. Our new system has solved this problem with CO₂ dissolution mechanism.”

This Hybrid Na-CO₂ System is far from the only carbon capture system out there, but it remains to be seen whether these technologies can ever become practical enough at large scales to have much of an impact. Climeworks' direct air



Scientists have developed a new device that can absorb CO₂ and produce electricity and hydrogen fuel (Credit: jordano/Depositphotos)



A diagram showing how the Hybrid-Na-CO₂ System works (Credit: UNIST)

capture system is one of the most promising at the moment, but when it only removes 150 tons of CO₂ a year (compared to the 40 billion tons released into the atmosphere annually) it feels like bailing a sinking ship with a plastic cup.

But, the team says, there's still room for improvement with every component of the new design. And the icing on the cake could be the system's ability to also produce renewable electricity and hydrogen fuel, which could be used to power hydrogen cars.

The research was published in the journal *iScience*.

<https://newatlas.com/hybrid-co2-capture-hydrogen-system/58145/>

International CANADA

EV COUNCIL OF OTTAWA

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TEVA | Taiwan Electric Vehicles Association

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United States

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National Electric Drag Racing Association

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SACRAMENTO EVA (SacEV)

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SAN JOSE EAA

Web site: rotordesign.com/sjeaa
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SILICON VALLEY EAA

Web site: www.eaasv.org
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MISSOURI

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EAA NORTHERN NEVADA

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LAS VEGAS EVA

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NEW JERSEY EAA (NJEEA)

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NEW MEXICO EVA (NNMEV)

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GREATER NY EAA

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OREGON EVA

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PENNSYLVANIA

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TENNESSEE

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TEXAS

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AUSTIN AAEAA

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HOUSTON EAA

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NORTH SOUND EVA

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TACOMA EVA (TACEVA)

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WENATCHEE EVA (WEVA)

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Contact: Jack Anderson, 509-784-1747

WASHINGTON D.C.**EVA OF WASHINGTON DC**

Web Site: evadc.org

Contact: Ron Kaltenbaugh

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WEST VIRGINIA**WEST VIRGINIA ELECTRIC
AUTO ASSOCIATION (WVEA)**

Web Site: www.wveaa.org

Contact: Marty Weirick, 304 610-1617

WISCONSIN**WISCONSIN EAA**

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High Power “Ruggedized” Electric Vehicle Charging Stations now Available from ClipperCreek, Inc.

ClipperCreek’s popular 48 and 64 Amp HCS Series charging stations are now offered with overmolded connectors, field-replaceable connector latches, and five year warranties, ideal for extreme conditions and high utilization applications.

The HCS-60 and HCS-80, two of ClipperCreek’s highest-powered Level 2 electric vehicle charging stations, are now available in “Ruggedized” configurations. The **HCS-60R** and **HCS-80R** feature rubber overmolded SAE-J1772™ connectors for added impact and crush resistance, field-replaceable connector latches, and are backed by five year warranties. These high-power, ruggedized charging stations offer reliable and affordable high-power level 2 charging solutions designed specifically for heavy utilization fleets, public parking lots, and extreme weather locations. The ruggedized option is offered at an excellent value of \$100 in addition to the base price of \$899 for the HCS-60 and \$969 for the HCS-80.

“We saw great customer acceptance with our first set of ruggedized products, the **HCS-40R** and **PMD-10R** and have continued to receive requests for the higher-powered ruggedized options,” said Will Barrett, ClipperCreek Director of Sales. “ClipperCreek’s standard products are very robust, all have NEMA 4 rated enclosures for indoor or outdoor installs. The overmolded ruggedized SAE-J1772™ connector takes our already tough products to another level.”

“Our commitment to the electric vehicle market drives us to bring the greatest value to our customers at every opportunity. As the market continues to evolve and vehicle options increase commercial customers have asked for our ruggedized stations in other power levels, so we developed a new overmolded connector with a replaceable latch for the HCS-60 and HCS-80. We stand behind this connector’s



Hardwired

durability by offering a five year product warranty.”

Features of the **HCS-60R** and **HCS-80R** include:

- 11.5 – 15.4kW of power to charge electric vehicles quickly
- Impact and crush resistant SAE-J1772™ connector
- Type 4X watertight and corrosion resistant rubber overmolded EV connector
- New slim high power cable design for improved flexibility and cold weather performance
- 25 feet of charging cable for installation flexibility and superior vehicle reach

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- 5-year warranty
- Field-replaceable latch
- Wall mount **SAE-J1772™ connector holster** included
- Integrated cable wrap making storing the cable simple and convenient
- Rugged, fully sealed NEMA 4 station enclosure for installation anywhere
- Support from the outstanding ClipperCreek customer service team
- No assembly required
- Made in America



For customers desiring access control, ClipperCreek offers **ChargeGuard**, compatible with the **HCS-60R** and **HCS-80R**. ChargeGuard is a reliable key-based access control solution designed for fleet, workplace, multi-tenant, hospitality and residential charging applications and is a \$78 option. **Share2** allows power sharing from a single circuit between two charging stations; Share2 is available for both the HCS-60R and HCS-80R.

[View a video demonstrating the durability of the HCS-40 EV Charging Stations as well as a video of the installation of a hardwire EV Charging Station. See these videos and read the Press Release at:

<https://www.clippercreek.com/>]



Introducing the HCS-60R and HCS-80R Ruggedized EV Charging Stations

Ultimate durability for the toughest conditions

LEVEL 2 | 240 Volt | 48 or 64 Amp | 25 Foot Cable

Impact and crush resistant overmolded connector

Field replaceable latch

5 year warranty



HCS-60R
Ruggedized HCS
\$100
option

In addition to \$899 base price
Total \$999 as shown



Learn more call 877-694-4194

RELIABLE
POWERFUL
MADE IN AMERICA