

# EVs - Late Summer 2023

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## 1. Introduction

The prior EV paper was posted on August 10. It is described and linked below.

### **EVs Mid-Summer 2023**

#### Technology:

*The 2030 National Charging Network*

*New Battery Chemistry (or Chemistries?)*

*Hot and Cold Weather Impacts on EVs*

*How Long Do Electric Car Batteries Last?*

#### Business:

*Tesla:*

- *Tesla Q2 2023 earnings: Expectations beat amid record quarter*
- *Tesla Model 3 Gets another Price Cut*
- *2024 Model 3*

*First Chevy Blazer EV en route to the US*

*Stellantis Second Battery Factory*

*Nikola California Hydrogen Refueling Stations*

*Bipartisan Infrastructure Law Funding to Boost Buses*

*Big Busses also get boosted*

<https://energycentral.com/c/ec/evs-mid-summer-2023>

This paper covers the following subjects:

#### Technology

What's next for Batteries?

GM Bets Big on Iron

#### Business

*Tesla:*

- *Tesla's Native Lands Partnerships*
- *Why Elon is Glad*
- *2024 Model 3*

*LG Energy / Honda Venture*

*Subaru's New EV Strategy*

*New Nissan Vehicles*

*Nikola, Still Struggling and Focused on Hydrogen*

## 2. Technology

Without doubt, the most important technology for battery-electric vehicles (BEVs) are the batteries. Most BEV designs for light vehicles simply described are a bottom structural battery container (a.k.a., the skateboard), one or more electric motors driving two or four wheels, and container(s) for a driver, passengers, cargo and misc. other components.

If you look at where the cost for BEVs come from, a large percentage of it is batteries, battery container and battery-support electronics. Most future cost reductions for EVs will be mainly driven by technology improvements in the batteries and related systems.

Given the above, I've decided to focus on EV batteries for this section. I've covered most of the developments earlier, but I thought the first reference below did an excellent job of collecting this information and putting it in a contextual format. I only interjected a link to an earlier paper once.

### 2.1. What's next for Batteries

*Every year the world runs more and more on batteries. Electric vehicles passed 10% of global vehicle sales in 2022, and they're on track to reach 30% by the end of this decade.<sup>1</sup>*

*Policies around the world are only going to accelerate this growth: recent climate legislation in the US is pumping billions into battery manufacturing and incentives for EV purchases. The European Union, and several states in the US, passed bans on gas-powered vehicles starting in 2035.*

*The transition will require lots of batteries—and better and cheaper ones.*

*Most EVs today are powered by lithium-ion batteries, a decades-old technology that's also used in laptops and cell phones. All those years of development have helped push prices down and improve performance, so today's EVs are approaching the price of gas-powered cars and can go for hundreds of miles between charges. Lithium-ion batteries are also finding new applications, including electricity storage on the grid that can help balance out intermittent renewable power sources like wind and solar...*

*At the same time, concerns about supplies of key battery materials like cobalt and lithium are pushing a search for alternatives to the standard lithium-ion chemistry.*

*In the midst of the soaring demand for EVs and renewable power and an explosion in battery development, one thing is certain: batteries will play a key role in the transition to renewable energy. Here's what to expect in 2023.*

*Some dramatically different approaches to EV batteries could see progress in 2023, though they will likely take longer to make a commercial impact.*

#### 2.1.1. Solid State Batteries

*One advance to keep an eye on this year is in so-called solid-state batteries. Lithium-ion batteries and related chemistries use a liquid electrolyte that shuttles charge around; solid-state batteries replace this liquid with ceramics or other solid materials.*

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<sup>1</sup> Casey Crownhart, MIT Technology Review, "What's next for batteries," Jan 4, 2023, <https://www.technologyreview.com/2023/01/04/1066141/whats-next-for-batteries/>

*This swap unlocks possibilities that pack more energy into a smaller space, potentially improving the range of electric vehicles. Solid-state batteries could also move charge around faster, meaning shorter charging times. And because some solvents used in electrolytes can be flammable, proponents of solid-state batteries say they improve safety by cutting fire risk.*

*Solid-state batteries can use a wide range of chemistries, but a leading candidate for commercialization uses lithium metal. QuantumScape, for one, is focused on that technology and raised hundreds of millions in funding before going public in 2020. The company has a deal with Volkswagen that could put its batteries in cars by 2025.*

**Author's comment:** See the earlier post described and linked below for more information on QuantumScape.

**New Battery Technology:** In this post we will look at two more lithium-ion battery designs that include solid electrolytes and metallic lithium anodes and a third similar design that was reviewed earlier. All three of these designs have progressed enough to where they should be in EVs that are on the road by 2025, but it has been a long road.

<https://energycentral.com/c/ec/new-battery-technology>

### **2.1.2. Sodium Ion Batteries**

*Sodium-ion batteries also swerve sharply from lithium-ion chemistries common today. These batteries have a design similar to that of lithium-ion batteries, including a liquid electrolyte, but instead of relying on lithium, they use sodium as the main chemical ingredient. Chinese battery giant CATL reportedly plans to begin mass-producing them in 2023.*

*Sodium-ion batteries may not improve performance, but they could cut costs because they rely on cheaper, more widely available materials than lithium-ion chemistries do. But it's not clear whether these batteries will be able to meet needs for EV range and charging time, which is why several companies going after the technology, like US-based Natron, are targeting less demanding applications to start, like stationary storage or micro-mobility devices such as e-bikes and scooters.*

*Today, the market for batteries aimed at stationary grid storage is small—about one-tenth the size of the market for EV batteries, according to Yayoi Sekine, head of energy storage at energy research firm BloombergNEF. But demand for electricity storage is growing as more renewable power is installed, since major renewable power sources like wind and solar are variable, and batteries can help store energy for when it's needed.*

*Lithium-ion batteries aren't ideal for stationary storage, even though they're commonly used for it today. While batteries for EVs are getting smaller, lighter, and faster, the primary goal for stationary storage is to cut costs. Size and weight don't matter as much for grid storage, which means different chemistries will likely win out.*

### **2.1.3. Iron-based Batteries**

*One rising star in stationary storage is iron, and two players could see progress in the coming year. Form Energy is developing an iron-air battery that uses a water-based electrolyte and basically stores energy using reversible rusting. The company recently announced a \$760 million manufacturing facility in Weirton, West Virginia, scheduled to begin construction in 2023. Another company, ESS, is building a different type of iron battery that employs similar chemistry; it has begun manufacturing at its headquarters in Wilsonville, Oregon.*

*Lithium-ion batteries keep getting better and cheaper, but researchers are tweaking the technology further to eke out greater performance and lower costs...*

*Cathodes are typically one of the most expensive parts of a battery, and a type of cathode called NMC (nickel manganese cobalt) is the dominant variety in EV batteries today. But those three elements, in addition to lithium, are expensive, so cutting some or all of them could help decrease costs.*

*This year could be a breakout year for one alternative: lithium iron phosphate (LFP), a low-cost cathode material sometimes used for lithium-ion batteries.*

*Recent improvements in LFP chemistry and manufacturing have helped boost the performance of these batteries, and companies are moving to adopt the technology: LFP market share is growing quickly, from about 10% of the global EV market in 2018 to about 40% in 2022. Tesla is already using LFP batteries in some vehicles, and automakers like Ford and Volkswagen announced that they plan to start offering some EV models with the chemistry too.*

#### **2.1.4. Advanced Anodes**

*Most anodes in lithium-ion batteries today, whatever their cathode makeup, use graphite to hold the lithium ions. But alternatives like silicon could help increase energy density and speed up charging.*

*Silicon anodes have been the subject of research for years, but historically they haven't had a long enough lifetime to last in products. Now though, companies are starting to expand production of the materials.*

*In 2021, startup Sila began producing silicon anodes for batteries in a wearable fitness device. The company was recently awarded a \$100 million grant from the Department of Energy to help build a manufacturing facility in Moses Lake, Washington. The factory will serve Sila's partnership with Mercedes-Benz and is expected to produce materials for EV batteries starting in 2025.*

*Other startups are working to blend silicon and graphite together for anodes. OneD Battery Sciences, which has partnered with GM, and Sionic Energy could take additional steps toward commercialization this year...*

## **2.2. GM Bets Big on Iron**

*General Motors is leading a \$60 million series B financing round in Mitra Chem, a Silicon Valley-based developer of iron-based cathode active materials used to manufacture electric vehicle batteries, the automaker said Wednesday.<sup>2</sup>*

*Mitra Chem employs machine learning models to synthesize and evaluate thousands of different battery chemistries each month, significantly shortening development time and getting EV batteries to market faster.*

*Iron-based battery cathode materials are more sustainable than other materials since they eliminate the need for raw materials like nickel and cobalt.*

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<sup>2</sup> Eric Walz, Automotive Dive, "GM leads \$60M investment in Mitra Chem to develop low-cost EV batteries," Aug 17, 2020, <https://www.automotivedive.com/news/general-motors-invests-60m-mitra-chem-develop-nickel-iron-cathode-EV-batteries/691141/>.

### **3. Business**

#### **3.1. Tesla**

##### **3.1.1. Tesla's Native Lands Partnerships**

*Tesla is going to repeat a loophole it has previously used to open stores and service centers where direct sale laws prevent it by operating on Native land. This time, the automaker is doing it in New York.<sup>3</sup>*

*There are a few states in the US that have laws prohibiting direct sales of electric vehicles to the public without going through third-party dealerships.*

*Now, however, car dealerships are using those old laws to prevent automakers that never had deals with third-party franchise dealers, like Tesla, from selling their vehicles to the public, even though it's fair competition. Tesla has been fighting those laws in many states with some success.*

*In New York, the law still exists, but Tesla managed to get an exemption to open a few stores and service centers...*

*In New Mexico, Tesla found an interesting way to get around the direct sale ban. In 2021, Tesla managed to open its first store and service center in the state by opening inside an old casino north of Santa Fe, and it did it by partnering with the First Nation of Nambé Pueblo and opening the location on their tribal land...*

*Now Tesla is taking the loop to New York. Syracuse news reports that Tesla made a deal with Oneida Indian Nation to build a location... on their land:*

##### **3.1.2. Why Elon is Glad**

*The declining price of lithium will make a huge difference in the affordability of making and buying electric vehicles, and Elon Musk is particularly happy about it.<sup>4</sup>*

*An easing of supply pressures has seen the cost of lithium carbonate halved, while nickel and cobalt — other important materials used in the production of EV batteries — have also seen a drop in prices.*

*On a Tesla earnings call, company CEO Musk noted that “lithium prices went insane there for a while,” but he added that deflationary pressures seemed to be prevailing.*

*The price reductions will make production costs more affordable, making price cuts more feasible for EV producers — and prices better for customers. Tesla has already slashed the prices of its more expensive models in a bid to boost demand...*

*The possibility of better lithium batteries is seen as one of the most crucial factors in the move away from dirty energy. While the generation of power via solar and wind is well-known and increasingly common, storing that energy is a bigger problem.*

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<sup>3</sup> Fred Lambert, Electrek, “Tesla brings Native land loophole to New York to avoid dumb direct sale ban,” Jun 6 2023, <https://electrek.co/2023/06/06/tesla-brings-native-land-loophole-new-york-avoid-dumb-direct-sale-ban/>

<sup>4</sup> Leo Collis, Bloomberg via Yahoo News, “Elon Musk issues strong statement on the cost of EV battery materials: ‘As we look ahead a few years’ ...” Aug 10, 2023, <https://news.yahoo.com/elon-musk-issues-strong-statement-050000222.html>

*In cars especially, power storage is a vital factor in purchasing decisions. The ability to travel greater distances on a single charge is a huge pull factor, but having heavy batteries can be detrimental to an EV's performance. Lighter lithium batteries, therefore, are favored.*

*Tesla is constructing a lithium refinery in Texas, which is set to be completed in 2024, according to the Austin American-Statesman. According to Reuters, Musk said at the groundbreaking ceremony that the facility would produce enough lithium to help build around one million EVs by 2025.*

*"As we look ahead a few years, a fundamental choke point in the advancement of electric vehicles is the availability of battery grade lithium," Musk added.*

### **3.1.3. 2024 Model 3**

*After six years, and blockbuster sales amounting to two million units sold globally, Tesla has given the Model 3 a refresh with aesthetic enhancements, more range, and feature upgrades. Following a fanatical public discourse around numerous spy shots and speculations, the new Model 3 could be one of the most anticipated electric vehicles of the year. See the images on the next page.*

*The updated Model 3, which was apparently internally codenamed Project Highland, is more chiseled, flaunts a redesigned front and rear, and gets a revamped interior. Tesla said it has improved its aerodynamics to extract more range and to reduce drag and wind noise. For now, the updates have come only to the rear-wheel-drive and long-range (LR) versions.<sup>5</sup>*

*The front end is edgier than before with cleaner character lines, a redesigned headlamp housing, and new signature LED daytime running lights. The crease at the edge of the hood that previously tapered off under the headlamps is now much sharper and extends to the fenders.*

*The side profile remains identical, while the rear end features prominent wraparound C-shaped taillights, with Tesla now spelled out between the lights, replacing the logo. The multi-spoke wheel design is also new. The brand is adding two new colors, Ultra Red and Stealth Gray.*

*The dimensions remain largely the same, but the Model 3 is now longer by an inch, measuring 185.8 inches (4,720 millimeters), while it is one-tenth of an inch shorter in height at 56.7 inches (1,441 mm). Ground clearance on the other hand is negligibly reduced from 5.5 inches (140 mm) to 5.4 inches (138 mm), as per the spec sheet.*

*The estimated WLTP range for the updated RWD Model 3 with 18-inch wheels is 344 miles (554 kilometers), while the LR variant is good for 421 miles (678 km). That's roughly an 11 to 12 percent increase from the current models' WLTP range of 305 and 374 miles, respectively. Note that the EPA figures will vary significantly for the US-spec electric sedan...*

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<sup>5</sup> Suvrat Kothari, Inside EVs Global, "New Tesla Model 3 Debuts," Aug 31, 2023, <https://insideevs.com/news/684589/updated-tesla-model-3-unveiled/#~:text=Deliveries%20of%20the%20updated%20Model%203%20will%20begin,of%20Tesla%20EVs%2C%20and%20a%20global%20export%20hub>



*The Model 3 interior now appears more lounge-like. It features a wraparound design, with an “enveloping architecture” featuring aluminum and fabric materials. The new ambient lighting covers the entire cabin. The brand claimed that the cabin is quieter thanks to acoustic glass and improved soundproofing materials.*

*There’s more digital real estate inside. The 15.4-inch central screen is the same size but features slimmer bezels for a more usable screen area. There’s also a new 8.0-inch rear display with integrated climate, ventilation, and infotainment controls. Tesla has replaced column-mounted levers with steering-mounted controls, like the Model S and Model X.*

### **3.2. LG Energy / Honda Venture**

*The fits and starts over the decades of trying to build a market for electric vehicles in the U.S. may be ready to finally pay off, says a key executive of one of the world's biggest battery companies, which has partnered with Honda in Ohio and other automakers to build batteries to power those vehicles.<sup>6</sup>*

*"The (automakers) are highly committed at this point and the products will be there," Robert Lee, who leads LG Energy Solution's operations in North America, told The Dispatch. "Nobody know 100% exactly how much the market they will penetrate (or) how fast."*

*"I do see the signals this time around that the market will take hold," said Lee, in an interview from Honda's Heritage Center in Marysville. "I'm a believer that there will be long coexistence of EVs and (internal combustion engines). ... I don't believe ICEs will immediately drop off and go away."*

*The South Korean company and the Japanese automaker announced plans last October to invest at least \$3.5 billion to build a factory to make batteries for Honda electric vehicles that will start production by the end of 2025. Lee is president and CEO of the joint venture.*

*The companies broke ground on the 2-million-square-foot plant in Jeffersonville in Fayette County in February that will produce batteries exclusively for Honda and Acura vehicles. LG owns 51% of the plant and Honda 49%.*

*LG is competing with a number of companies to serve the growing market for EVs while also partnering with some of the biggest automakers in the world on similar projects.*

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<sup>6</sup> Mark Williams, The Columbus Dispatch via Yahoo Finance, “LG Energy explained...,” Aug 1, 2023, [https://finance.yahoo.com/news/lg-energy-explained-ceo-shares-100104851.html?guccounter=1&guce\\_referrer=aHR0cHM6Ly93d3cuYmluZy5jb20v&guce\\_referrer\\_sig=AQAAAEQz7wgZtzkxqTvhVBrnTepkwvogpCuWuZ0h\\_7aBiZ3HTaQNapNfi8blnNyyrH2J88OnBC27TF9nvqo3oWeSjd9-fsxp3qyuEavvPTKX4ALPSGY2S1egBnKn8N7CtFMV8\\_qfluRU3jqzanrH8FXw-LvTIDEodoNBTU04dMNANS11](https://finance.yahoo.com/news/lg-energy-explained-ceo-shares-100104851.html?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuYmluZy5jb20v&guce_referrer_sig=AQAAAEQz7wgZtzkxqTvhVBrnTepkwvogpCuWuZ0h_7aBiZ3HTaQNapNfi8blnNyyrH2J88OnBC27TF9nvqo3oWeSjd9-fsxp3qyuEavvPTKX4ALPSGY2S1egBnKn8N7CtFMV8_qfluRU3jqzanrH8FXw-LvTIDEodoNBTU04dMNANS11)

*"Whoever demonstrates they're the best will become a market leader. I'm not saying there will be only one battery player, but there will be fewer. ... I feel like LG Energy Solution right now has a better chance to be that No. 1 company than any other company," he said...*

*LG Energy Solution's history dates to 1947 in South Korea with the formation of Lucky Chemical. The name was subsequently changed to LG Chem.*

*In 1992, the company began its first research on lithium-ion batteries. Initially, the work supported cell phones, personal computers and consumer electronics before going into battery development for vehicles.*

*In 2020, the company spun off the battery business and formed LG Energy Solution. The same year, LG Energy and GM formed Ultium Cells, an EV battery company with three plants, including in Warren in northeast Ohio. The Warren plant began producing battery cells last August (Aug 2022).*

*LG has struck similar partnerships in the U.S. with Hyundai Motor Group and Stellantis, along with the Honda deal.*

### **3.3. Subaru's New EV Strategy**

*Subaru has reinvented its electric vehicle sales targets in a sudden and drastic shift from its historically tempered expectations.<sup>7</sup>*

*The automaker initially hoped to sell 400,000 electric vehicles worldwide starting in 2028, a much more conservative estimate than General Motors' forecast of 1 million units for 2025. But on Wednesday, newly appointed Subaru CEO Atsushi Osaki shared a new strategy that, if successful, would see the brand sell 400,000 EVs in the U.S. alone by 2028. The plan additionally calls for fully-electric vehicles to comprise half of the brand's global sales by the end of the decade, a sharp increase from its initial target of 40% from combined sales of hybrids and EVs.*

*To meet these new targets, Subaru has now doubled its planned lineup to include eight battery-powered models, the first of which, the 2023 Solterra SUV, has already launched. The company also intends to restructure its business model, halving the time spent on product development to support a faster transition to electric vehicles...*

### **3.4. New Nissan Vehicles**

*Nissan was a pioneer in U.S. EVs with their Leaf, but failed to follow up with additional EVs until recently. Now it has introduced a potential replacement for the EV (image below), and announced two additional EVs.*

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<sup>7</sup> Colin Velez, CBT News, "Subaru revamps electric vehicle strategy, now targets U.S. sales of 400,000," Aug 2, 2023, <https://www.cbtnews.com/subaru-revamps-electric-vehicle-strategy-now-targets-u-s-sales-of-400000/>



*Nissan showcased its electric vehicle future for its dealers this week as it unveiled its lineup of three new EVs that included its next-generation Leaf crossover coupe that would replace its hatchback model that will be discontinued. It also previewed a performance sedan that could replace its internal combustion engine vehicle Maxima, as well as an electric crossover SUV built on the Ariya dedicated CMF-EV platform, Electrek reported.<sup>8</sup>*

*The Japanese automaker's EV ramp up is expected to hit the market in 2025. The company targets 27 new electrified models that include 19 new all-electric vehicles by fiscal year 2030, according to its revised electrification plan released in February.*

### **3.5. Nikola, Still Struggling and Focused on Hydrogen**

I just found an excellent article on the title manufacturer's current status. One reason I subscribe to Forbes is that they are focused on investors, and one the most important consideration for this group is whether a given firm will survive. This is important, and not assured for Nikola.

*Electric truck-maker Nikola has had a bad month. Since it announced a surprise management change just days before recalling all its battery-powered big rigs for potential fire risk, its stock has tumbled 61%. But amid the turmoil, the company says it remains on track to be the first manufacturer to deliver hydrogen fuel cell semis to customers this year.<sup>9</sup>*

<sup>8</sup> Kirk O'Neil, The Street, "Longtime Tesla rival unveils 3 new electric vehicles," Aug 26, 2023, <https://www.thestreet.com/electric-vehicles/longtime-tesla-rival-unveils-3-new-electric-vehicles>

<sup>9</sup> Alan Ohnsman, Forbes, "Nikola's New CEO Says Hydrogen Semis Still Coming This Year As It Recalls Battery Trucks," Aug 24, 2023, [https://www.forbes.com/sites/alanohnsman/2023/08/24/nikolas-new-ceo-says-hydrogen-semis-still-coming-this-year-as-it-recalls-battery-trucks/?sh=14731cda7bce&utm\\_source=newsletter&utm\\_medium=email&utm\\_campaign=currentclimate&cdclid=628673ca6e1a1d1211f1d747](https://www.forbes.com/sites/alanohnsman/2023/08/24/nikolas-new-ceo-says-hydrogen-semis-still-coming-this-year-as-it-recalls-battery-trucks/?sh=14731cda7bce&utm_source=newsletter&utm_medium=email&utm_campaign=currentclimate&cdclid=628673ca6e1a1d1211f1d747)

*The recall, announced Aug. 11, affected all 209 Tre BEV trucks delivered to customers and dealers in the past year, but a fix is in the works, CEO Steve Girsky told Forbes, without elaborating. Production of the model at Nikola's Coolidge, Arizona, plant had already stopped temporarily owing to a surplus of unsold units and preparations to build fuel cell Tres on the same assembly line.*

*"We've started the process of pulling trucks back to get them worked on at Coolidge and then it's about launching the hydrogen truck," said Girsky, previously Nikola's chairman, who began running the Phoenix-based company just days before the recall. "There are challenges with any launch and we're grinding through those. Everything this company had the vision for three years ago is coming to a head in the next six months in terms of launching the hydrogen truck and getting the stations up. It's the chicken and the egg coming together."*

*Nikola's survival as a company could hinge on its ability to scale up production of nonpolluting hydrogen trucks — which it says will be able to haul loads at least 500 miles per tank — and ensure there are stations to provide the fuel.*

*Girsky, a long-time equity analyst and former General Motors vice chairman, is tightening Nikola's business strategy from the wide-ranging vision of ousted founder Trevor Milton, who is awaiting sentencing for securities and wire fraud convictions. Three years ago, the company's plans also included large-scale production facilities making "green" hydrogen from water and renewable power, international operations, a pickup truck, electric watercraft and all-terrain and military vehicles. Now it's limited to building and selling hydrogen and battery trucks and setting up fuel stations with partner companies...*

*In July, the company was awarded about \$42 million from the California Transportation Commission to open six heavy-duty hydrogen stations with partner Voltera, but it will take a few years to get them up and running. So to provide fuel for its first hydrogen trucks, which are heading to California, it will initially use mobile fueling units that can support up to 30 trucks per day...*

*For the moment, the company's financial situation has stabilized, Girsky told Forbes. In July, Nikola sold its green hydrogen production facility in Phoenix to Fortescue Future Industries for \$24 million and now plans to source fuel from it for its trucks. And this week it raised \$125 million with a convertible bond offering that investors don't seem to like, with an option to raise up to \$200 million more. Those funds will help cover costs related to launching the hydrogen truck business but will also be needed for recall expenses, which may be "significant," it said in a filing. Additionally, "there can be no assurance as to when we will be able to resume production of our BEV trucks," the company said.*

*Problems with the battery truck business are the latest setback in the rocky three years since Nikola went public, but the company intends to continue building them. Girsky said there's demand for such vehicles for short-range trucking routes, such as from ports in Southern California to distribution centers. Hydrogen trucks, however, remain its core focus. And it wants to get into that market ahead of big competitors like Daimler, Hyundai (which operates Xcient fuel cell trucks at the Port of Oakland) and Toyota (which is making fuel cell systems for truck-maker Kenworth).*