

EVs, Late Fall 2023

By John Benson

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1. Introduction

I believe that this paper will post near the end of November, and the prior “EV...” paper was posted on October 5, almost two months prior to this one. This means the pace of these posts are slowing down, although not posts on the general subject of EVs. This series is on road-going EVs, and all types of these are becoming commodities. However, other types of electric vehicles, and the technology for these are continuing to evolve, and I will continue to cover these (collectively) at a high frequency.

The last EV Post is described and linked below.

EVs Early Fall 2023: This EV Paper has the following content:

Technology:

- *Trade-offs: Price vs. Range vs. Performance*
- *Are Chargers Keeping Pace with EV Expansion?*

Business:

- *Record Global EV Sales, Growth expected through 2023*
- *A \$3 Billion Truck Venture*
- *EVs Switch gets \$12 billion in loans & grants from DOE*
- *EX30, the Smallest, Least Expensive Volvo*

<https://energycentral.com/c/ec/evs-early-fall-2023>

This EV Post contains the following content:

Technology:

- *Fast-Charging vs. Battery-Lifetime*
- *BMW Believes its Next-gen EVs will Beat Tesla's range*
- *Tesla 4680 battery cell production breakthrough*

Business:

- *Volvo Group Acquires Proterra For \$210 Million*
- *EVs Transform the Auto Industry*
- *Future EVs*
- *Caddy's Next EV will be a Compact SUV*

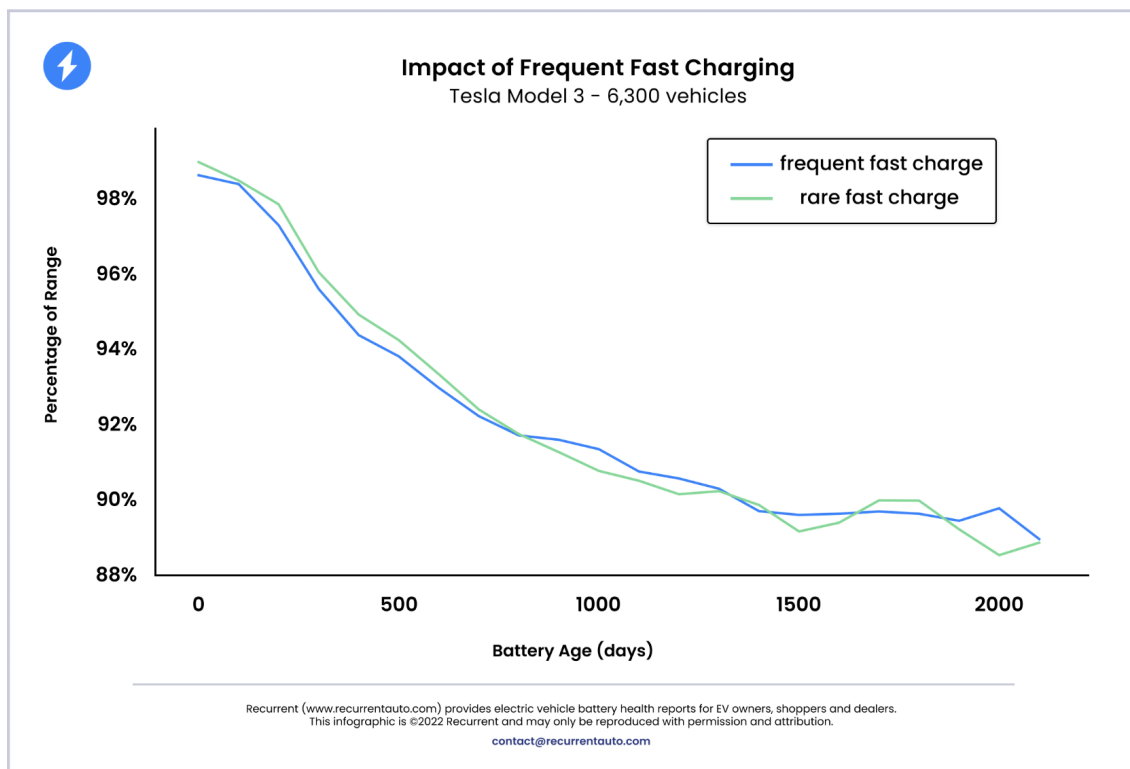
2. Technology

2.1. Fast-Charging vs. Battery-Lifetime

The question is a simple one: If you fast-charge your EV frequently will it reduce your battery's capacity? However, this is actually a complex question, given the number of different EV-battery designs and charger designs. In order to give a simple (definitive and useful) answer the reference for this subsection constrains the answer to the most popular brand and models.

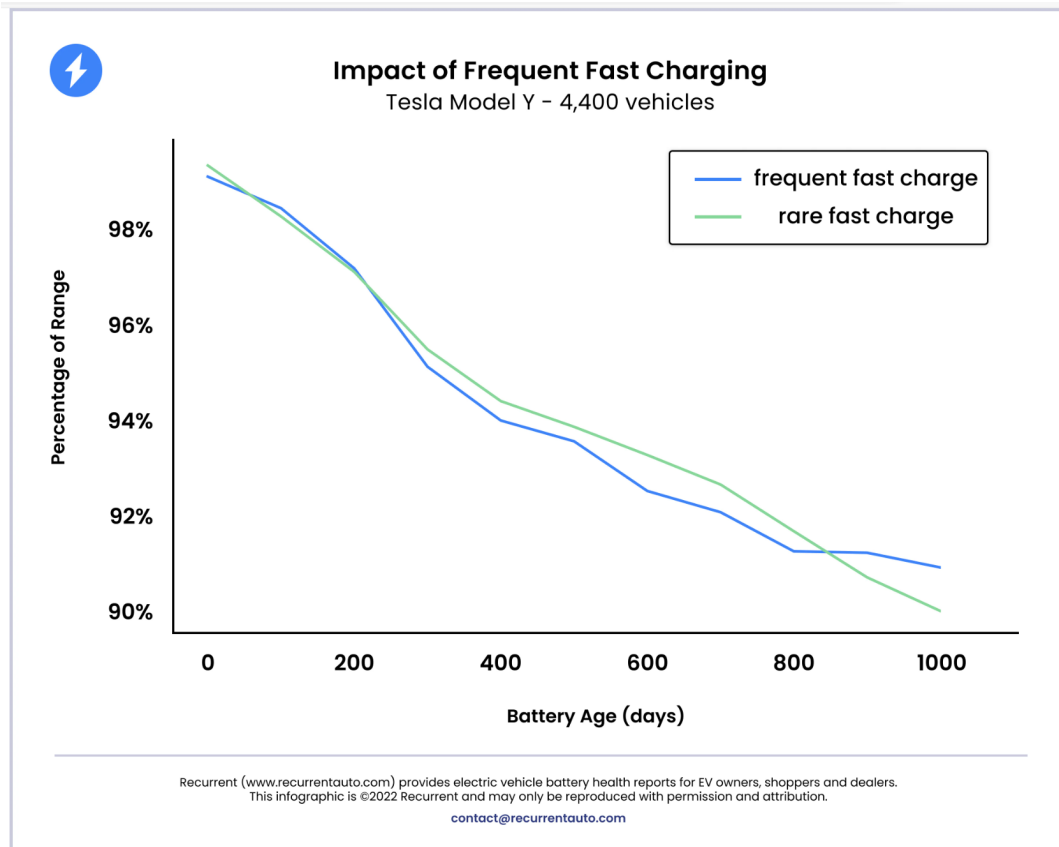
...Recurrent studied fast charging on over 12,500 Tesla vehicles in the US to learn if the software and safety mechanisms in the battery management system (BMS) prevent damage to the battery. With Labor Day travel coming up, this is the perfect time to share what is fact and what is fiction when it comes to fast charging.¹

We compared cars that fast charge at least 90% of the time to cars that fast charge less than 10% of the time. In other words, people who almost exclusively fast charge their car and people who very rarely fast charge. The results show no statistically significant difference in range degradation between Teslas that fast charge more than 90% of the time and those that fast charge less than 10% of the time.



Impact of Fast Charging on Model 3s in the Recurrent Community

¹ Hope Miranda and Blake Hough, Recurrent, “Full Speed Ahead: EV Study Reveals Impacts of Fast Charging,” Aug 28, 2023, <https://www.recurrentauto.com/research/impacts-of-fast-charging>



Impact of Fast Charging on Model Ys in the Recurrent Community

The charts above show the percentage of original range as shown on the cars' dashboards. Note that the dashboard range in Teslas is different from its Real Range, which is a value that factors in the range effects of temperature, drive style, and terrain.

Initial analysis by the team at Recurrent suggests that the study findings can be applied across Tesla models and other EV manufacturers, although detailed research is being conducted on other popular vehicles that Recurrent supports. In short, the robust thermal, voltage, and battery management systems that EV makers have invested in do protect their batteries from damage with routine fast charger use.

Author's comment: I did a deep dive into EV's Battery Management Systems in the last issue of this series which is described and linked in the Intro of this issue.

2.2. BMW Believes its Next-gen EVs will Beat Tesla's range

In a recently published interview with Automotive News Europe, BMW Group production boss Milan Nedeljkovic said the automaker doesn't see a gap to Tesla, and that the Tesla may in fact need to catch up to BMW once the German automaker's sixth-generation batteries enter production with the Neue Klasse family of EVs starting in 2025.²

² Stephen Edelstein, Green Car Reports, "BMW Claims Tesla is no Longer Ahead in Range, Battery Tech," Nov 3, 2023, https://www.greencarreports.com/news/1141329_bmw-claims-tesla-is-no-longer-ahead-in-ev-range-battery-tech

BMW previously said the new battery hardware, highlighted by a switch to cylindrical cells, will target 20% greater energy density and up to 30% more range, resulting in up to 500 miles per charge (likely as measured on the more lenient European WLTP testing cycle), and 60% lower production-related carbon emissions than its current-generation prismatic cells.

The new cylindrical cells will have a diameter of 46 millimeters and heights of either 95 millimeters or 120 millimeters, according to the report, with higher nickel and lower cobalt content on the cathode side and increased silicon content on the anode side, according to the Automotive News Europe report. That's quite different from Tesla's choice of 4680 cells measuring 46 millimeters in diameter and 80 millimeters tall for use in the Semi and Cybertruck...

Author's comment: Note that I'm not a Tesla Fan-Person, and criticize them when it is due, but they have more experience in designing and shipping EV batteries than all of the other EV manufacturers in the world combined. Also, BMW's design-move sounds like something that Tesla did several years ago when they started using 4680 cells. Perhaps BMW hopes to get some good news from their results on the absurd European WLTP testing cycle, but I believe EV-Makers in the US need to follow the EPA's Urban Dynamometer Driving Schedule (UDDS), and the Highway Fuel Economy Test Driving Schedule (HWFET), which are much more realistic than the European cycle.³

See the next subsection for Tesla's counterpoint.

2.3. Tesla 4680 battery cell production breakthrough

Today (Oct 11), Tesla has confirmed a significant breakthrough in 4680 battery cell production at Gigafactory Texas as it produced its 20 millionth battery cell at the factory.⁴

We haven't had many updates on Tesla's 4680 battery cell production, which is believed to be critical to the automaker's new vehicle programs, like the Cybertruck. Tesla unveiled the 4680 cell, its first cell designed from the ground up, at Battery Day in 2020.

The automaker claimed the potential to reduce battery cost by over 50% with the new design; it has been trying to bring it to volume production since but has run into some bottlenecks.

We got a few updates about the ramp-up over the last few years, but Tesla always refused to disclose its production rate – until now – to some degree.

Today, Tesla announced that it has built its 20 millionth 4680 cell at Gigafactory Texas.

It now gives us some idea of the production rate since Tesla announced the production of the 10 millionth 4680 cell at Giga Texas in June.

Therefore, we know that Tesla produced 10 million 4680 cells in the last 16 weeks.

³ Benjamin Hunting, Capital One Auto Navigator, "How Does the EPA Calculate EV Range?," Aug 2, 2022, <https://www.capitalone.com/cars/learn/finding-the-right-car/how-does-the-epa-calculate-ev-range/1677>

⁴ Fred Lambert, Electrek, "Tesla announces 4680 battery cell production breakthrough," Oct 11, 2023, <https://electrek.co/2023/10/11/tesla-4680-battery-cell-production-breakthrough/>

That's an average of 625,000 cells per week, but it is fair to assume that production is now well above this average. Let's say 800,000 cells per week, just to play it safe.

Tesla's 4680 cell is believed to have a capacity of about 26 Ah, though it might have improved recently – there's no way to know...

3. Business

3.1. Volvo Group Acquires Proterra For \$210 Million

The mood around the canapé table at CleanTechnica was somber in August when we learned that Proterra had filed for bankruptcy. We like to think the EV revolution will deliver all those who aspire to selling electric vehicles to the promised land of high sales and big profits, but that is sadly not the case.⁵

Just as there are hundreds of car companies that have come and gone since Karl Benz built his first car (many older readers are still dismayed that stalwarts such as Pontiac and Plymouth have left the stage), there will be many electric vehicle manufacturers who will fade into oblivion as well. But we had high hopes for Proterra, we really did.

Here was an innovative company that started out making electric buses using carbon fiber for low weight and durability. It became a charging and battery specialist which helped those who wanted to transition to electric vehicles figure out how to make it happen.

In addition to delivering dozens of its innovative electric buses to the city of Miami, it collaborated with Valley Transportation in Santa Clara County, California, to create a solar microgrid capable of charging multiple electric buses. It supplied Thomas Built Buses with battery packs for 200 electric school buses and agreed to be the battery supplier for Volta and Lightning eMotors electric trucks.

Proterra opened a battery manufacturing center in Los Angeles that put a priority on giving inner city residents an opportunity to learn new skills that would qualify them for good paying jobs in the electric vehicle industry. Those workers are all members of United Steel Workers Local 675.

At that time, the company said, "In addition to its transit business, Proterra provides its road-tested and proven electric vehicle technology and expertise to other heavy- and medium-duty commercial vehicle manufacturers through the company's Proterra Powered program."

"Proterra battery systems have been chosen by world-class OEMs to introduce 100% battery-electric vehicles, including delivery vans, electric school buses, coach buses, and low-floor cutaway shuttle buses. To date, Proterra Powered has helped world-class OEMs like Thomas Built Buses, Van Hool, Freightliner Custom Chassis Corporation (FCCC), Bustech, and Optimal-EV introduce 100% battery-electric vehicles that are powered by Proterra electric vehicle technology."

With all that good karma at the foundation of the company, how could it fail? But fail, it did. The gozoutas were just more than the gozintas, which meant Proterra always needed to borrow more money to stay afloat. In September, the company admitted its business model was just not sustainable and filed for bankruptcy protection.

⁵ Steve Hanley, Clean Technica, "Volvo Group Acquires Proterra For \$210 Million," Nov 10, 2023, <https://cleantechnica.com/2023/11/10/volvo-group-acquires-proterra-for-210-million/>

In a terse press release dated November 10, 2023, Volvo Group said, “Proterra Inc. and Proterra Operating Company Inc. are in a voluntary Chapter 11 bankruptcy process in the US. Volvo Group has been selected as the winning bidder in an auction for the business and assets of the Proterra Powered business unit at a purchase price of \$210 million.”

“The transaction between Proterra Inc. and Proterra Operating Company as sellers and Volvo is subject to approval by the bankruptcy court in the US. In addition, closing of the transaction, which is expected early 2024, will be subject to merger clearance and certain other conditions.

“The assets to be acquired include a development center for battery modules and packs in California and an assembly factory in South Carolina. With this acquisition, Volvo Group will complement the current, and accelerate its future battery-electric road map. The transaction has no material impact on the Volvo Group financial performance.”

Proterra filed for Chapter 11 bankruptcy protection — which is effectively a self-administered bankruptcy proceeding for restructuring a business — in August. At that time, it spoke of a “strategic initiative to strengthen [its] financial position and sharpen [its] technology focus...”

Proterra just ramped up production at a new battery assembly plant in Greer, South Carolina, in January of this year. The company operates another plant in California. In both cases, cylindrical cells from LG Energy Solution are processed into battery packs used in Proterra’s electric buses and by third party customers. Since business operations will continue, the customer projects mentioned remain unaffected for now.

One of the curiosities in this arrangement is that Volvo Group is owned by Geely, a Chinese manufacturer of electric vehicles that includes such brands as Zeeker, Geometry, Link ‘N Company, London Electric Vehicle Company, Lotus Cars, Polestar, Proton, and Volvo Cars. Geely shares typically trade in the \$1.00 to \$2.00 range on NASDAQ, which might suggest the company has limited market value. And yet it has managed to assemble a massive presence in the world of electric vehicles.

We will be curious to see how Geely leverages its newfound acquisition. Volvo Group manufactures trucks, buses, construction equipment, and power solutions for marine and industrial applications. In other words, Proterra should be a perfect fit for its business.

There is always the possibility that one day, Geely will break out of its low public profile and we will learn it is one of the success stories of the marker transition from cars and trucks with internal combustion engines to battery powered vehicles. And Proterra will be recognized as an important part of that success. Stranger things have happened in the auto business.

3.2. EVs Transform the Auto Industry

While EV sales have slowly ticked up for years, they're now soaring. The emissions-free cars and trucks will likely account for 13% of all new auto sales globally in 2022, up from 4% just two years earlier, according to the International Energy Agency. They're on track to make up about 30% of those sales by the end of this decade.⁶

A mix of forces has propelled the vehicles from a niche choice to a mainstream option.

Governments have enacted policies compelling automakers to retool and incentivizing consumers to make the switch. Notably, California and New York will require all new cars, trucks, and SUVs to be zero-emissions by 2035, and the EU had nearly finalized a similar rule at press time.

Auto companies, in turn, are setting up supply chains, building manufacturing capacity, and releasing more models with better performance, across price points and product types.

The Hongguang Mini, a tiny car that starts a little below \$5,000, has become the best-selling electric vehicle in the world, reinforcing China's dominance as the largest manufacturer of EVs.

A growing line-up of two- and three-wheelers from Hero Electric, Ather, and other companies helped EV sales triple in India over the last year (though the total number is still only around 430,000). And models ranging in size and price from the Chevy Bolt to the Ford F-150 Lightning are bringing more Americans into the electric fold.

There are still big challenges ahead. Most of the vehicles must become cheaper. Charging options need to be more convenient. Clean electricity generation will have to increase dramatically to accommodate the surge in vehicle charging. And it will be a massive undertaking to make enough batteries. But it's now clear that the heyday of the gas-guzzler is dimming.

3.3. Future EVs

Car and Driver Magazine just published a humongous listing of EVs that will be available in the next few years. I decided to cherry pick these below, as I have covered many of these in past issues. The bad news is that I will need to go back to past issues and eliminate any redundant information.

3.3.1. Acura ZDX (Expected: Early 2024)

You may recognize the ZDX name from Acura's old coupe-SUV model, but this time around the moniker adorns a midsize crossover that becomes Acura's first EV when it arrives early next year. The 2024 ZDX rides on General Motors' Ultium battery platform—sharing components with the Cadillac Lyriq—and the 102.0-kWh battery will provide up to 325 miles of range. The 340-hp, single-motor, rear-wheel-drive A-Spec model will be joined by a 500-hp, dual-motor, all-wheel-drive Type S, which also wears upgraded brakes, adaptive dampers, and air suspension. The A-Spec should start around \$60,000. —Caleb Miller⁷

⁶ James Temple, MIT Technology Review, "The inevitable EV," Jan 9, 2023, <https://www.technologyreview.com/2023/01/09/1064889/the-inevitable-ev-10-breakthrough-technologies-2023/>

⁷ Various authors (see individual models), Car and Driver, "Future Electric Vehicles: The EVs You'll Soon Be Able to Buy," Nov 3, 2023, <https://www.caranddriver.com/news/g29994375/future-electric-cars-trucks/>



ACURA

3.3.2. Jeep Recon (Expected: 2024)

Been waiting for an all-electric Jeep Wrangler? The forthcoming Recon isn't exactly that, but it's pretty dang close. Jeep claims it'll have "impressive" clearances for off-roading, and the EV SUV will have removable glass and doors too. A retractable roof and rear-mounted spare complete the Wrangler vibe. The Recon's legitimate trail-rated capabilities will be further supported by chunky tires and underbody protection. Locking diffs should help make the most of what's sure to be an all-wheel-drive powertrain. We don't yet know how much power it'll make or how long of range it'll have, but we expect those details to emerge well before the Jeep Recon is slated to start production sometime in 2024. —Eric Stafford



JEEP

3.3.3. Jeep Wagoneer S (Expected: 2024)

Think of the Jeep Wagoneer S as an all-electric alternative to the more conventional Jeep Grand Cherokee. Many details about the company's upcoming mid-size EV SUV remain a mystery—like its actual name. Jeep says "Wagoneer S" is a placeholder while it picks an official title. That and more will be revealed before the Wagoneer S goes into production, likely sometime in 2024. For now, all we have are images of a sharply designed concept along with several tantalizing targets. Jeep claims the final model will have 400 miles of range, however, that figure will change based on how often drivers exploit its planned 600-hp electric powertrain. —Eric Stafford

Author's comment. Note that I confirmed the 2024 date on the Jeep Site linked below.

<https://www.jeep.com/ev.html>



3.3.4. Lincoln Star (Expected: 2024)

Lincoln aims to switch to a fully electric lineup by 2030. We expect a production version of the Star to arrive in late 2024 as a 2025 model year and become Lincoln's first EV. The Star concept revealed in 2022 looks half like a Lincoln Aviator and half like a spaceship. Lincoln says the production mid-sized two-row crossover will come with both rear- and all-wheel drive powertrain options. The concept's cabin features a full-width digital display on the dash, sculpted bucket seats, an integrated beverage chiller, crystal accents, and rose gold colored trim pieces. We expect range and power output to be similar to the Ford Mustang Mach-E, with a starting price around \$70,000. —Jack Fitzgerald



3.3.5. Mercedes-Benz EQG (Expected: Late 2023)

Mercedes-Benz is giving the EV treatment to its beloved G-wagen. The company debuted this concept at the 2021 Munich auto show. The EQG will have a motor at each wheel for four-wheel drive capability. Details on pricing, range, and horsepower haven't been revealed. Few automakers have teased an off-road EV, but when the EQG comes out, likely next year, it will compete with the GMC Hummer EV. —Austin Irwin

Author's comment: The earlier EV Post linked below, subsection 2.2 is on the Sila Nanotechnologies battery that will be used by the EQG. It has another image of this EV.

EVs Mid-Spring, 2023

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



3.4. Caddy's Next EV will be a Compact SUV

When Cadillac unveiled the massive Escalade IQ this past summer, executives promised we would see two additional electric Cadillacs by the end of the year. While we don't if GM's recently slow down of its EV ramp up will impact the announcement of the second new Cadillac, we now have at least one, the upcoming Optiq.⁸

At this point, we know very little about the Optiq except that it will be the entry level model in the electric Cadillac lineup. Spokeswoman Stephanie Obendorfer provided the following statement along with two photos:



Cadillac Optiq EV CADILLAC

“OPTIQ will act as the entry point for Cadillac’s EV lineup in North America, slotting in below LYRIQ as a luxury compact SUV. OPTIQ’s spirited driving dynamics are designed to appeal to global luxury customers. Additional details, features and pricing will be unveiled next year.”

⁸ Sam Abuelsamid, Forbes, “Cadillac’s Next EV Will Be The Compact Optiq,” Nov 17, 2023, https://www.forbes.com/sites/samabuelsamid/2023/11/17/cadillacs-next-ev-will-be-the-compact-optiq/?ss=transportation&sh=288df4c73b4d&utm_source=newsletter&utm_medium=email&utm_campaign=currentclimate&cdclid=628673ca6e1a1d1211f1d747§ion=deals