Electric Vehicles, Spring 2022

By John Benson

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1. Introduction

I started this document in early March, but then I ripped out part of it and posted it on March 10, and this is the remainder. The ejected part was had really good and timely content as described and linked below.

Electric Trucks and Buses in California: This paper is much longer that I like to post, but I thought it better to leave it together rather than splitting it. It is not just for my normal reader, but also for stakeholders of private and public organization that are involved in the title subject. Mostly in California, but also outside of our state…

This post will take a deep dive into California requirements and incentives for medium and heavy electric trucks, buses and related technologies, and look at why California is doing this. This paper will also dive into truck and bus manufacturers and their products. And finally, we will review U.S. federal incentives for electric trucks and buses.

https://energycentral.com/c/ec/electric-trucks-and-buses-california

This post will cover a range of subjects related to both electric cars, heavier vehicles and their components.

2. GM's Ultium Battery and Tesla

It took me a while to dig out detailed information on the title battery. It turns out that I missed the initial information on this when it came out almost a year ago:

Tesla is expected to become the first automaker to use LG Energy Solution's new NCMA battery cells, which have a 90% nickel composition.[1]

Over the last few years, Tesla has been adopting more new chemistries in its battery cells for its electric vehicles, especially with new vehicles being produced at Gigafactory Shanghai.

By validating new chemistries, Tesla can get access to new supplies of cells and expand its production without relying on battery manufacturers to increase their production capacity.

The automaker has also been looking for battery cell chemistries that are using less cobalt and a higher concentration of nickel.

Last year, it was reported that Tesla had reached an agreement with LG Energy Solution, one of the world's biggest battery manufacturers, to use the company's new NCMA battery cells.

[1] Fred Lambert, Electrek, "Tesla is expected to be first to use LG's new NCMA nickel-based battery cells," Jun. 2nd 2021, https://electrek.co/2021/06/02/tesla-first-lg-new-ncma-nickel-based-battery-cells/

The nickel-rich NCMA battery chemistry has been something that LG has been working on for a while now, and it is expected to increase energy density of the cells.

GM was expected to be the first to use LG's new NCMA battery cells in the new GMC Hummer EV starting in September, but now a new report indicates that Tesla might get the cells first.

Korean newspaper Business Korea reports:

"LG Chem will supply NCMA (nickel, cobalt, manganese, aluminum) cathode materials for electric vehicle batteries to Tesla in July. This marks the company's first commercial production of NCMA cathode materials."

The new batteries are reportedly going to be used in Tesla Model Y vehicles being produced at Gigafactory Shanghai…

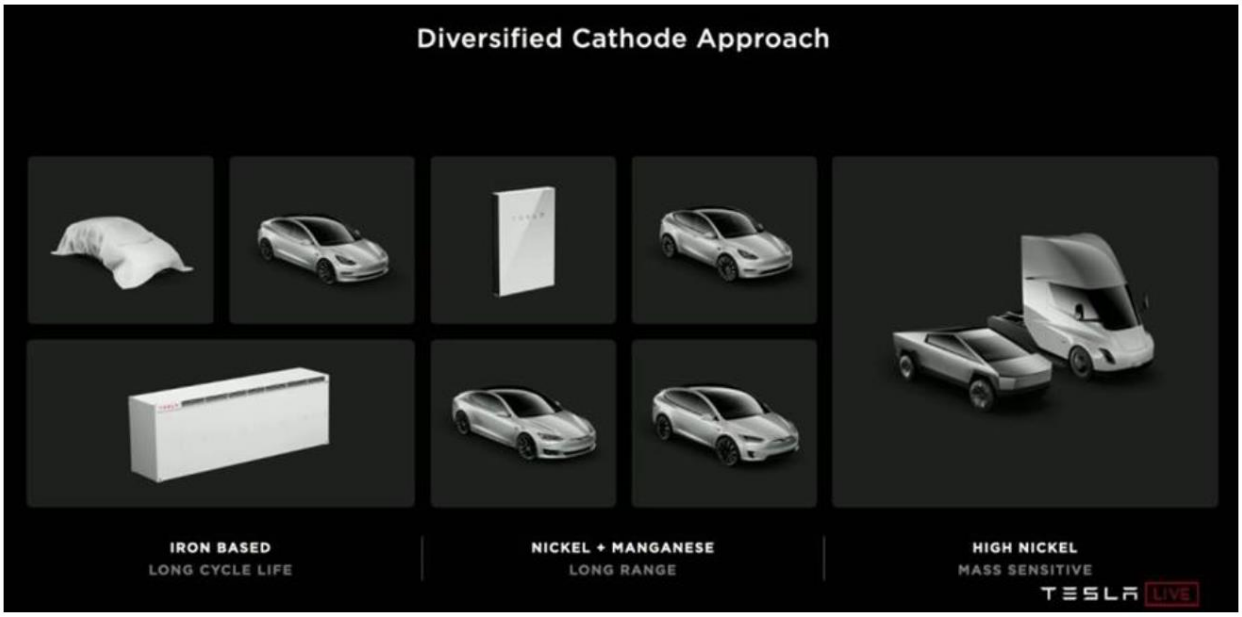
Tesla is currently ramping up production of the Model Y electric SUV at Gigafactory Shanghai, which is expected to contribute significantly to the automaker's growth during the second half of the year.

The automaker has also been getting closer to LG's new separate business unit for battery production…

In September, shortly after Tesla held its "Battery Day" event, reports came out that Tesla is looking to acquire a stake in LG's battery business.

Later, we also reported that LG Chem announced that it will produce a new battery cell with exactly the same specs as Tesla's newly announced 4680 cell…

And finally an update of a Tesla "Battery Day" slide (with my explanation below) that I use from time to time:



The "IRON BASED" battery in the above figure is LFP ($LiFePO_4$ or Lithium Iron Phosphate). The "NICKEL + MANGANESE" is NMC ($LiNi_XMn_YCoZO_2$ or Lithium Nickel Manganese Cobalt Oxide),

and the "HIGH NICKEL" is NCA ($LiNi_XCo_YAlZO_2$ or Lithium Nickel Cobalt Aluminum Oxide) and ultimately LG Chem's new NCMA chemistry (Nickel Cobalt Manganese Aluminum), which has the highest nickel content.

The materials cost of the NCMA is much higher on any basis than the LFP, which Tesla will use in its lower-priced cars. This is probably why GM is mainly rolling out only high-end EVs currently.

3. Panasonic Moves

Most long-time Tesla-watchers know that Panasonic was the original battery supplier for this EV leader. Also, Panasonic was Tesla's partner in Gigafactory 1 (Reno). However, as Tesla has come to dominate EV and battery energy storage system (BESS) markets world-wide, they needed to diversify their supply of lithium-ion batteries via other manufacturers, and more recently started to manufacture their own batteries. However, Panasonic and Tesla still have a strong partnership as indicated by the news below.

…Tesla and Panasonic already built a factory together in the US: Gigafactory Nevada.[2]

…Now it looks like the two companies are planning to replicate this success on an even larger scale.

Japan's NHK reports that Panasonic is currently in the process of purchasing land in the United States to build a "mega-factory" to build battery cells for Tesla (via Reuters):

"Japan's Panasonic Corp is looking to purchase land in the United States for a mega-factory to make a new type of electric vehicle (EV) battery for Tesla Inc, public broadcaster NHK reported on Friday…

"Panasonic is looking at building the factory, to cost several billion dollars, in either Oklahoma or Kansas for their proximity to Texas, where Tesla is preparing a new EV plant, NHK reported. NHK gave no timeline for Panasonic's U.S. project.

"Panasonic recently confirmed plans to start production of Tesla's 4680 battery cell by March 2024, but that will happen at a factory in Japan…"

If accurate, these unconfirmed plans would mean a brand new factory built from the ground up to support Tesla's rapidly growing production in the United States – specifically in Texas where Tesla just started production of the Model Y.

The automaker is currently using 4680 battery cells that the company is building itself at a pilot production plant in California and deploying its own battery cell production capacity at Gigafactory Texas.

However, Tesla has made it clear that it would buy any cell it could get its hands on from suppliers for the foreseeable future…

Speaking of the "4680 battery cell… pilot production plant in California…" this is the Kato Road Plant in Fremont, and it has been doing a reasonable job:

Tesla has announced that it has produced 1 million of its next-generation 4680 battery cell at its pilot factory in California.[3]

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[2] Fred Lambert, Electrek, "Panasonic is planning a large battery cell factory in the US to supply Tesla's demand, report says," March 3, 2022, https://electrek.co/2022/03/03/panasoni-large-battery-cell-factory-in-us-supply-tesla-demand-repor/

[3] Fred Lambert, Electrek, "Tesla announces it has produced 1 million next-gen 4680 battery cells," Feb 18, 2022, https://electrek.co/2022/02/18/tesla-produced-1-million-next-gen-4680-battery-cell/

The announcement comes as Tesla is expected to start deliveries of its new Model Y equipped with its 4680 cell and structural battery pack.

Since the unveiling, Tesla has been producing the 4680 cells at a "pilot production facility" in Fremont and deploying large-scale production at other factories, including Gigafactory Texas and Gigafactory Berlin.

While Tesla is calling it a "pilot factory," the automaker had announced a goal to produce 10 GWh of battery cells at the plant, which is more than many other full-scale battery cell factories.

Last month, Tesla's SVP of engineering, Drew Baglino, said that Tesla was making "meaningful progress" in ramping production at the pilot plant, but he didn't confirm the production capacity.

Now Tesla has announced that it has produced its one-millionth 4680 cell at the Kato road facility in January…

If you look at all of the above news regarding Tesla's battery supply, it looks like they are planning to have plenty of their 4680 cells this year through 2024 to support their production ramps of the model Y, Cybertruck (2023-2024) and Semi (2023-2024). From my last post on medium-to-heavy EVs (linked in the Introduction), it looks like Semi will have plenty of competition. Also, read on.

4. Tesla Needs More of Everything

Tesla is seeing its order rate surging in the US, according to sources familiar with the matter, as the record gas prices are turning more people toward electric vehicles.[4]

However, it won't significantly affect its deliveries since the automaker is still production-constrained.

Amid the crisis in Ukraine and sanctions to put pressure on Russia to end its invasion, oil and gas prices have increased significantly.

Crude oil is now at over $100 per barrel, and the average gas price at the pump in the US was at $4.25 a gallon – with some regions seeing $5 a gallon.

This is going to affect virtually every industry, but it is also an important enough increase that many people are having to change their budget for gas.

Every time they go to the gas station, they are reminded that a geopolitical situation is costing several more dollars just to get to work.

Now many of them who are in a position to buy a new car are turning toward electric vehicles. Some out of frustration, others because they are making the cost of ownership calculation and realize that it is actually cheaper than a gas-powered car.

Tesla is the biggest EV brand in the US by a long shot. About 80% of all electric cars in the country are Tesla vehicles, and unsurprisingly the company is starting to feel an increase in orders from gas price pressure…

[4] Fred Lambert, Electrek, "Tesla (TSLA) order rate is surging in the US as gas prices are turning people toward electric cars," March 10, 2022, https://electrek.co/2022/03/10/tesla-tsla-order-rate-surging-us-gas-prices-turning-people-to-electric-cars/

4.1. More Gigafactories

Finally Giga Austin and Giga Berlin are starting to ramp production of Model Ys. Giga Shanghai had been supporting much of the European market (and others), and Elon can clearly see, even after Giga Berlin reaches a reasonable volume, Tesla will need more production out of China to support other EV Markets.

It appears that Tesla might have already decided on the location of its next big factory. Based on recent reports, it appears that Tesla may be looking to build another vehicle production facility in Shanghai — and it could be starting sooner than expected. [5]

Citing individuals familiar with the matter, Reuters noted that Tesla is currently looking to work on its new Shanghai plant as early as next month. This should allow the company to more than double its production capacity in China. It should also help Tesla meet the increasing demand for its vehicles in foreign territories. The cost of the project is yet to be announced.

The publication noted that once the new facility is fully ramped, Tesla would have the capacity to manufacture up to 2 million cars per year from its China operations. Reuters' sources also noted that the new vehicle production facility would be located in the vicinity of Gigafactory Shanghai. It would then be interesting to see if the new facility would be considered as a completely new Gigafactory or if it would be considered as an expansion of Giga Shanghai.

Giga Shanghai has been Tesla's ace in the hole for the past year. Since its lightning-quick construction, the facility has built high-quality Model 3 and Model Y that have since been exported to other countries. Last year alone, Tesla's China-based factory accounted for about half of the 936,000 vehicles that the company delivered globally, as per data from the China Passenger Car Association. Tesla also noted earlier this month that its China revenue more than doubled in 2021 to $13.8 billion.

5. Cummins Moves

Cummins (noted for a market-leading Diesel Engine), has been moving toward EVs in a big way, and they have been moving for some time:

June 2, 2018: The Company, mostly known for its diesel engines, is now investing $500 million into electrification over three years. It announced powertrain/battery products for trucks, buses and other equipment…[6]

5.1. Battery Electric Vehicles

In the case of batteries, Cummins relies on Brammo, whose assets concerning battery storage were acquired in late 2017.

However Cummins is not totally focused on supporting battery electric vehicles, they have also invested heavily in fuel-cell electric vehicles.

[5] Simon Alvarez, Teslarati, "Tesla planning new Shanghai plant as soon as next month to double its China capacity: report," Feb 24, 2022, https://www.teslarati.com/tesla-second-gigafactory-shanghai-report/
[6] Mark Kane, INSIDE EVS, "Cummins Reveals New Lithium-Ion Battery Lineup," June 2 2018 https://insideevs.com/news/338187/cummins-reveals-new-lithium-ion-battery-lineup/

Cummins began developing its fuel cell capabilities more than 20 years ago and the acquisition of Hydrogenics accelerates Cummins' ability to further innovate and scale hydrogen fuel cell technologies across a range of commercial markets.[7]

In addition to acquiring Hydrogenics, Cummins also recently announced an investment in Loop Energy, a fuel cell electric range extender provider, and signed a memo of understanding with Hyundai Motor Company to collaborate on hydrogen fuel cell technology across commercial markets in North America.

Cummins also offers a range of electrolyzers[8] and has formed a joint venture with NPROXX*, "a leader in hydrogen storage and transportation, for hydrogen storage tanks…*[9]

A recent Cummins acquisition will allow them to provide complete power-train solutions:

Cummins Inc. (NYSE: CMI) and Meritor, Inc. (NYSE: MTOR) today announced that they have entered into a definitive agreement under which Cummins will acquire Meritor, a global leader of drivetrain, mobility, braking, aftermarket and electric powertrain solutions for commercial vehicle and industrial markets. Under the terms of the agreement, Cummins will pay $36.50 in cash per Meritor share, for a total transaction value of approximately $3.7 billion, including assumed debt and net of acquired cash.[10]

"The acquisition of Meritor is an important milestone for Cummins. Meritor is an industry leader, and the addition of their complementary strengths will help us address one of the most critical technology challenges of our age: developing economically viable zero carbon solutions for commercial and industrial applications," said Tom Linebarger, Chairman and CEO, Cummins. "Climate change is the existential crisis of our time and this acquisition accelerates our ability to address it. Our customers need economically viable decarbonized solutions…"

Meritor is an industry leader in axle and brake technology. The integration of Meritor's people, technology and capabilities will position Cummins as one of the few companies able to provide integrated powertrain solutions across combustion and electric power applications. This is the right time to pursue this combination as demand for decarbonized solutions accelerates. Cummins believes eAxles will be a critical integration point within hybrid and electric drivetrains. By accelerating Meritor's investment in electrification and integrating development within its New Power business, Cummins expects to deliver market-leading solutions to global customers.

One additional point: regenerative braking is even more important for medium and heavy vehicles than it is for light vehicles (cars and light trucks). I'm guessing somewhere in the mix of capabilities that Cummins is assembling is a leading technology for integrated braking from friction-brakes and EVs regenerative brakes.

Also keep in mind that Cummins will likely be providing drivetrain solutions to more medium and heavy EV companies than anyone else, since they already have strong

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[7] Michael Nagel, Cummins News Release, "From Advanced Diesel to Hydrogen: Four Ways Cummins is Committed to Meeting Energy Demands," Sep 22, 2020, https://www.cummins.com/news/2020/09/22/advanced-diesel-hydrogen-four-ways-cummins-committed-meeting-energy-demands

[8] https://www.cummins.com/new-power/applications/about-hydrogen

[9] https://www.cummins.com/news/releases/2020/06/23/cummins-form-joint-venture-nproxx-hydrogen-storage

[10] Business Wire via Yahoo Finance, "Cummins to Acquire Meritor," Feb 22, 2022, https://finance.yahoo.com/news/cummins-acquire-meritor-123000909.html

relationships with all of the mainstream IC vehicle-providers and are not competitors (that is, they don't and probably won't manufacture complete EVs).

6. Pickups

Now that Tesla has slipped the Cybertruck into 2023, the big news this year is the Ford F150 Lightning. Furthermore Ford is starting to schedule the production of these:

Ever since the 2022 Ford F-150 Lightning was revealed in May of 2021, FoMoCo has maintained that the all-electric pickup would launch this spring, even when false rumors began circulating that the model had been delayed. Now, it seems that at least one Ford F-150 Lightning order holder – Sergio Rodriguez – has received a scheduled for production email that he posted via Twitter, which seems to further confirm that the EV pickup will in fact launch this spring, even if it is later in the season.[11]

Rodriguez's F-150 Lightning Lariat is scheduled for production at the Ford Rouge Electric Vehicle Center the week of April 18th, 2022, which certainly puts it on track for a late spring launch. It's unclear how many Lightning scheduled for production emails have gone out as part of the model's first wave of order conversions, but this is certainly a good sign for those awaiting delivery of the first-ever all-electric Ford F-150…

As far as other pickups scheduled for production over the next few years, see the article linked below:

https://www.caranddriver.com/news/a29890843/full-electric-pickup-trucks/

The base version of the F-150 Lightning is the Pro. It cost slightly over $40,000 including destination charge, but without added taxes and license fees, and incentive credits. It comes standard with 4-wheel drive, 2.4 kW Pro Power OnBoard, Ford CoPilot 360™ driver assist, 230 miles range and Navigation. For additional information go through the link below.

https://www.ford.com/trucks/f150/f150-lightning/2022/

There are two downsides to the Lightning: (1) it has been reported that Ford currently has 200,000 Lightning reservations which means all will not be delivered until well into 2023. (2) It has also been reported that some dealers are attempting to charge excessive markups, but Ford appears to have a reasonable strategy to avoid this. Go through the link below for more information on the latter issue:

https://www.kbb.com/car-news/ford-warns-dealers-buyers-to-avoid-f-150-lightning-markups/

[11] Brett Foote, Ford Authority, "2022 Ford F-150 Lightning Trucks Are Being Scheduled For Production," Feb 24, 2022, https://fordauthority.com/2022/02/2022-ford-f-150-lightning-trucks-are-being-scheduled-for-production/