S&P Global
Market Intelligence

Tesla, Inc. NasdaqGS:TSLA

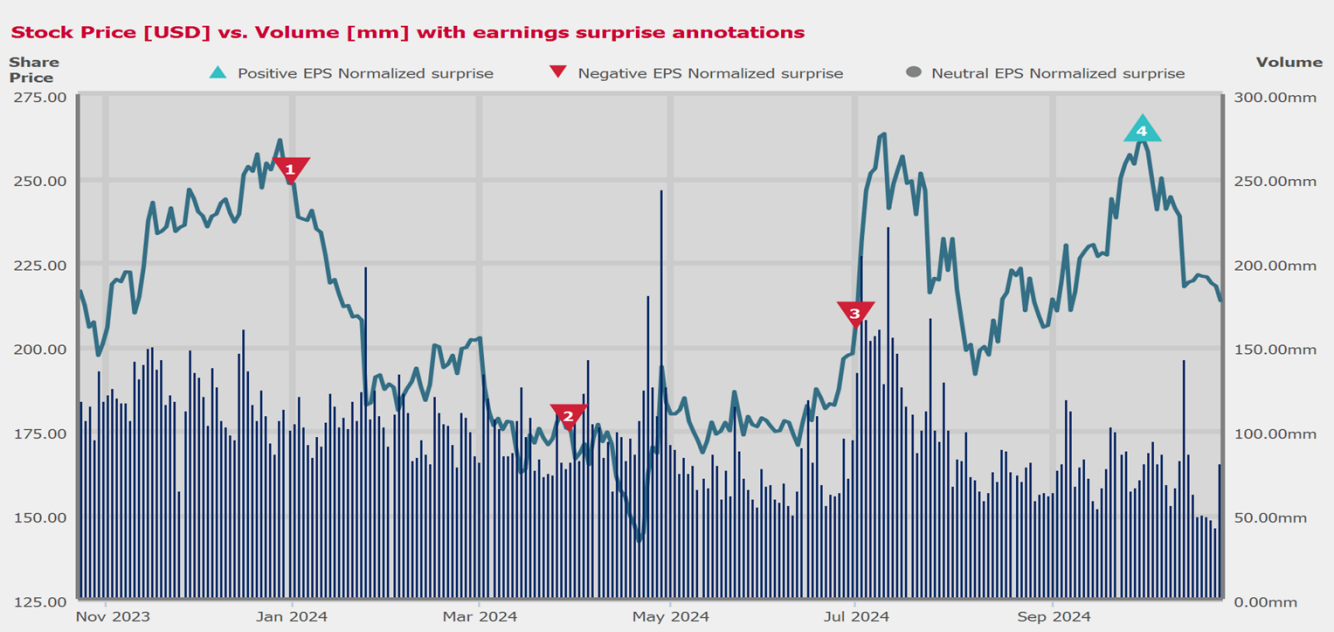
FQ3 2024 Earnings Call Transcripts

Wednesday, October 23, 2024 9:30 PM GMT

S&P Global Market Intelligence Estimates

	-FQ3 2024-			-FQ4 2024-	-FY 2024-	-FY 2025-
	CONSENSUS	ACTUAL	SURPRISE	CONSENSUS	CONSENSUS	CONSENSUS
EPS Normalized	0.60	0.72	20.00	0.73	2.35	3.17
Revenue (mm)	25496.74	25182.00	(1.23 %)	27009.70	100064.56	116438.24

Currency: USD
Consensus as of Oct-23-2024 10:15 PM GMT



- EPS NORMALIZED -

	CONSENSUS	ACTUAL	SURPRISE
FQ4 2023	0.74	0.71	(4.05 %)
FQ1 2024	0.49	0.45	(8.16 %)
FQ2 2024	0.62	0.52	(16.13 %)
FQ3 2024	0.60	0.72	20.00 %

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Call Participants

EXECUTIVES

Ashok Elluswamy
Executive Officer

David Lau

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Lars Moravy
Vice President of Vehicle Engineering

Travis Axelrod
Head of Investor Relations

Unknown Executive

Vaibhav Taneja
Chief Financial Officer

ANALYSTS

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Presentation

Travis Axelrod
Head of Investor Relations

Good afternoon, everyone, and welcome to Tesla's Third Quarter 2024 Q&A Webcast. My name is Travis Axelrod, Head of Investor Relations, and I'm joined today by Elon Musk, Vaibhav Taneja, and a number of other executives.

Our Q3 results were announced at about 3:00 p.m. Central Time in the update deck we published at the same link as this webcast.

During this call, we will discuss our business outlook and make forward-looking statements. These comments are based on our predictions and expectations as of today. Actual events or results could differ materially due to a number of risks and uncertainties, including those mentioned in our most recent filings with the SEC.

[Operator Instructions] Before we jump into Q&A, Elon has some opening remarks. Elon?

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Thank you. So to recap, as the automotive industry is seeing year-over-year declines in order volumes in Q3, Tesla, at the same time, has achieved record deliveries. In fact, I think if you look at EV companies worldwide, to the best of my knowledge, no EV company is even profitable. And to the best of my knowledge, there was no EV division of any company, of any existing auto company, that is profitable. So it is notable that Tesla is profitable despite a very challenging automotive environment, and this quarter actually is a record Q3 for us.

So we produced our seventh million vehicle actually just yesterday, so congratulations to the teams that made it happen in Tesla. That's a staggeringly immense amount of work to make 7 million cars. So let's see, we also have the energy storage business growing like wildfire with strong demand for both Megapack and Powerwall.

And as you well know, on October 10, we laid out a vision for an autonomous and electric future that I think is very compelling that the Tesla team did a phenomenal job there with actually giving people an option to experience the future where you have humanoid robots working among the crowd, not with a canned video and a presentation or anything, but actually walking among crowd, serving drinks and whatnot.

And we had 50 autonomous vehicles. There were 20 Cybercabs but there were an additional 30 Model Ys operating fully autonomously the entire night, carrying thousands of people straight with no incidents the entire night. And all those who went there, I think it's worth emphasizing that the Cybercab had no steering wheel or brake or accelerator pedals, meaning there was no way for anyone to intervene manually even if they wanted to, and the whole night went very smoothly.

So regarding the vehicle business, we are still on track to deliver our more affordable models starting in the first half of 2025. I think probably people are wondering, "Well, what should they assume for vehicle sales growth next year?" And at the risk of -- to take a bit of risk here, I do want to give some rough estimate, which I think it's 20% to 30% vehicle growth next year, notwithstanding negative external events, like if there's some force majeure events, some big war breaks out or interest rates go sky high or something like that. We can't overcome massive force majeure events, but I think, with our lower-cost vehicles, with the advent of autonomy, something like a 20% to 30% growth next year is my best guess.

And then Cybercab reaching volume production in '26, I do feel confident of Cybercab reaching volume production in '26, not just starting production but reaching volume production in '26. And that should be substantial. But we're aiming for at least 2 million units a year of Cybercab. That will be in more than 1

factory. But I think it's at least 2 million units a year, maybe 4 million ultimately. So yes, these are just my best guesses. If you ask me my best guesses, those are my best guesses.

The cell 4680 lines, the team is actually doing great work there. The 4680 is rapidly approaching the point where it is the most competitive cell. So when you consider the fully landed -- the cost of a battery pack fully landed in the U.S., net of incentives and duties, the 4680 is tracking to be the most competitive, maybe lower cost per kilowatt hour fully considered, than any other alternative. We're not quite there yet but we're close to being there, which I think is extremely exciting. And we've got a lot of ideas to go well beyond that. So I think if we execute well with 4680, the Tesla internally produced cell will be the most cost competitive cell in North America, a testament to the tremendous amount of hard work there done by the team.

So that said, we'll continue to buy a lot of cells from our competitors. I don't intend for that to mean make cells just internally, so I don't want to set off any alarm bells here. We're obviously increasing substantially our vehicle output and our stationary storage output, so we need a lot of cells. And most of them will still come from suppliers. But I think it is some good news that the Tesla internal cell is tracking to be the most competitive in the U.S.

So with respect to autonomy, as people are experiencing in the cars really from week to week, there are significant improvements in the miles between interventions. So with the new version 12.5 release of full self-driving in Cybertruck, combining the code into a single stack so that the city driving and the engine and highway driving are one stack, which is a big improvement for the highway driving, so it's just all neural nets, and the release of actually Smart Summon, we try to have a sense of humor here. So that's 12.5.

Version 13 of FSD is going out soon. I'm sure we'll elaborate more on that later in the call. We expect to see roughly a five or sixfold improvement in miles between interventions compared to 12.5. And actually, looking at the year as a whole, the improvement in miles between interventions, we think, will be at least 3 orders of magnitude. So that's a very dramatic improvement in the course of the year, and we expect that trend to continue next year. So the current internal expectation, internal expectation, for the Tesla FSD having longer miles between interventions and human is the second quarter of next year. It may end up being in the third quarter, but it seems extremely likely to be next year.

Ashok, do you want to maybe elaborate?

Ashok Elluswamy
Executive Officer

Yes. Miles between critical interventions, like you mentioned, Elon, we already made 100x improvement with 12.5 from the start of this year. And then with v13 release, we expect to be 1,000x from January of this year on the production release software. And this came in because of technology improvements, going to end-to-end, having higher frame rate, partly also helped by Hardware 4, more capabilities, and so on. And we hope that we continue to scale the neural network, the data, the training compute, et cetera. By Q2 next year, we should cross over the average, even in miles per critical intervention, probably collision, in that case.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

I mean, that is just unvarnished, our internal estimate.

Ashok Elluswamy
Executive Officer

Yes.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

So that's not sandbagging or anything else. Our internal estimate is Q2 of next year to be safer than human and then to continue with rapid improvements thereafter.

A vast majority of humanity has no idea that Tesla cars drive themselves. So especially for something like a Model 3 or Model Y, it looks like a normal car. So you don't expect a normal car to be able to be intelligent enough to drive itself. A Cybercab looks different. A Cybertruck looks different. But Model Y and Model 3, look, they're good-looking cars but they look fairly normal. You don't expect a fairly normal-looking car to have the intelligence, enough AI to be able to drive itself, but it does. So we do want to expose that to more people. And so we're doing -- every time we have a significant improvement in the software, we'll roll out another sort of 30-day trial so to encourage people to try it again. And we are seeing a significant improvement in adoption. So the take rate for FSD has improved substantially, especially after the 10/10 event. Yes. So there's no need to wait for a robotaxi or a Cybercab to experience full autonomy. We expect to achieve that next year with our existing vehicle line.

Ashok Elluswamy
Executive Officer

Actually, Smart Summon gives a small taste of what it's going to look like, the car able to drive itself to the user within private parking lots. Currently, it's speed-limited but then it's going to quickly be increased. We already had more than 1 billion usage in terms of Smart Summon.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes. And actually, for Tesla employees in the Bay Area, we already are offering ride-hailing capabilities. So actually, with the development app, you can request a ride and it will take you anywhere in the Bay Area. We do have a safety driver for now but the software required to do that, we've developed.

David, do you want to elaborate on that?

David Lau

Yes. Sure. It's David. We showed some screenshots of this in the Q1 shareholder deck. And this is real. We've been testing it for the better part of the year. And the building blocks that we needed in order to build this functionality and deliver it to production, we've been thinking about and working on for years. It just so happens that we've used those building blocks to deliver great features for our customers in the meantime, such as sharing your profile, synchronizing it across cars, so that every single car that you jump into, whether it's another car that you own or a car that somebody has loaned to you or a rental car that you jump into, it looks exactly like yours: everything synchronized, seat and mirror positions, media, navigation, everything is the same, just what you would expect from one of our robotaxis. But we gave that functionality to our customers right now because we've built it intending for it to be used in the future, so we're releasing that functionality now.

All the end-to-end cybersecurity that we knew we were going to need to deliver that functionality, sending a navigation destination from your phone to the vehicle, and so we're doing that now with the ride-hailing app, but it's something that we've made available to customers for years. Seeing the progress on a route in the mobile app, that's something you'll need for the ride-hailing app, but again, we released it in the meantime.

So it's not like we're just starting to think about this stuff right now while we're building out the early stages of our ride-hailing network. We've been thinking about this for quite a long time, and we're excited to get the functionality out there.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes. And we do expect to roll out ride-hailing in California and Texas next year to the public. Now in California, there's quite a long regulatory approval process. I think we should get approval next year, but it's contingent upon regulatory approval. Texas is a lot faster, so we'll definitely have it available in Texas and probably have it available in California, subject to regulatory approval, and maybe some other states

actually next year as well, but at least in California and Texas. So I think that would be very exciting. That's really a profound change. Tesla becomes more than a sort of vehicle and a battery manufacturing company at that point.

So we published our Q3 vehicle safety report, which shows 1 crash for every 7 million miles of autopilot. That compares to the U.S. average of 1 crash for roughly every 700,000 miles. So it's currently showing a 10x safety improvement relative to the U.S. average.

And we continue to expand our AI training capacity to accommodate the needs of both FSD and Optimus. We are currently not training compute constraint. Probably the biggest limiting factor is that the FSD is actually getting so good that it takes us a while to actually find mistakes. And when you start getting to where it can take 10,000 miles to find a mistake, it takes a while to actually figure out which it is. Is software ver A better than software ver B? It actually takes a while to figure it out because neither one of them makes the mistakes. They would take a long time to make mistakes. So it's actually the single biggest limiting factor is how long does it take us to figure out which version is better. That's sort of a high-class problem. Obviously, having a giant fleet is very helpful for breaking this out.

And then with Optimus, we showed a massive improvement in Optimus' dexterity movement on October 10. And our next-gen hand and forearm, which is 22 degrees freedom, which is double the prior hand and forearm. It's extremely human-like, and so it's much better at tactile sensing. I feel confident in saying that we have the most advanced humanoid robot by a long shot. And we're moreover the only company that really has all of the ingredients necessary to scale humanoid robots. Because the things that -- what other companies are missing is that they're missing the AI brain. They're missing the ability to really scale to very high-volume production. So you've seen some impressive video demos, but they like the localized AI and the ability to scale volume to very high numbers.

As I've said on a few occasions before, I think Optimus will ultimately be the most valuable product. So I think it has a good chance of being the most valuable product ever made.

For the energy business, that's doing extremely well. And the opportunity ahead is gigantic. The Lathrop Megapack factory reached 200 Megapacks a week, which is now a 40 gigawatt hour a year run rate. And we have a second factory in Shanghai that will begin with the 20 gigawatt hour year run rate in Q1 next year, so next quarter. And that will also scale up. It won't be long before we're shipping 100 gigawatt hours a year stationary storage at Tesla. And that will ultimately grow, I think, to multiple terawatt hours per year. It has to actually in order to have a sustainable energy future. If you're not at the terawatt scale, you're not really moving the needle.

So if you look at our admittedly very complicated last master plan, which I think actually is too much detail, I'll maybe ask Gaurav to analyze it and give us the TLDR on the last master plan. But we showed in that master plan that it is possible to take all of earth to a fully sustainable energy situation using sustainable energy, power generation and batteries and electric transport. And there are no fundamental material limitations, like there's not some very rare material that we don't have enough of. We actually have enough of raw materials to take all of human civilization, make it fully sustainable. And even if civilization dramatically increase its electricity usage, it would still be fully sustainable.

One way to think of the progress of a civilization, this may sound a little esoteric but it is percentage completion of Kardashev scale. So in Kardashev scale, 1 would be using all the power of a planet. We're currently less than 1% on Kardashev Level 1. Level 2 would be using all the power of the sun. And Level 3, all the power of the galaxy. So we have a long way to go, a long way to go. When you think in Kardashev terms, it becomes obvious that, by far, the biggest source of energy is the sun. Everything else is in the noise.

So in concluding, Tesla is focused on building the future of energy, transport, robotics and AI. And this is a time when others are just focused on managing around near-term trends. We think what we're doing is the right approach. And if we execute on our objectives, and I think we will, my prediction is Tesla will become the most valuable company in the world and probably by a long shot.

I want to thank the Tesla team once again for the strong execution in a tough operating environment, and we're looking forward to building an incredibly exciting future. Thank you.

Travis Axelrod
Head of Investor Relations

Great. Thank you very much, Elon. And Vaibhav has some opening remarks as well.

Vaibhav Taneja
Chief Financial Officer

Yes. Thanks. Our Q3 results were positive and once again demonstrated the scale to which the business has evolved over the years with the generation of record operating cash flows of $6.3 billion. Our automotive revenues grew both quarter-on-quarter and year-on-year. While we had unit volume growth, we did experience a reduction in ASPs primarily due to the impact of financing incentives. As a reminder, we are providing these incentives primarily using third-party banks and financial institution and recognize the cost of these incentives as an upfront reduction to revenue.

We released FSD for Cybertruck and other features like actually Smart Summon, like Elon talked about, in North America, which contributed $326 million of revenues in the quarter. We continue to see elevated levels of regulatory credit sales with over $2 billion of revenues so far this year. To expand on this, at an industry level, China continues to outperform U.S. and Europe by a factor of 3. And if there is something to be learned from that, this gives a signal of what is to come in other regions as customers' acceptance of EV grows. And we feel that is the right strategy to build affordable and more compelling leads.

Our focus remains on growing unit volume while avoiding a buildup of inventory. To support this strategy, we're continuing to offer extremely compelling vehicle financing options in every market. When you compare any vehicle in our lineup with other OEMs, we believe our vehicles provide much better value, particularly when you consider the safety features, performance and unparalleled software functionalities, like David also talked about, include also what Ashok had talked about around autonomy, music options, parental controls, and much more. While every vehicle in our lineup comes up with these capabilities, there is an awareness gap not just with buyers but at times even with existing owners. We plan on making these more visible in our interactions with both existing and future customers.

Automotive margins improved quarter-over-quarter as a result of the FSD feature release discussed before, increase in our overall production and delivery volume, continued benefit from commodity pricing and more localized deliveries in region, which resulted in lower freight and duties. Sustaining these margins in Q4, however, will be challenging, given the current economic environment. Note that we are focused on the cost per vehicle, and there are numerous work streams within the company to squeeze out cost without compromising on customer experience.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes. And something that's hopefully a helpful macro trend is, if there's a decline in the interest rates, this has a massive effect on the automotive demand. For the vast majority of people, the demand is driven by the monthly payment. Can they afford monthly payment? So I think most likely, we'll see a continued decline in interest rates, which helps with the affordability of vehicles.

Vaibhav Taneja
Chief Financial Officer

Yes. I mean that is one trend which we observed in the industry that, because of the affordability being impacted because of interest rates, people are holding on to the cars longer, especially in the U.S. And that is actually having an impact on the overall industry, too.

As we discussed earlier, as we discussed in prior quarters, energy deployments fluctuate quarter-on-quarter due to customer readiness, location of orders being fulfilled and not necessarily an indicator of demand or production within the quarter. While we did see a decline in Q3, we expect to grow deployment sequentially in Q4 to end the year more than double of last year.

Energy margins in Q3 were a record at more than 30%. This is a function of mix of projects being deployed in the quarter. Note that there will be fluctuation in margins as we manage through deployments and our inventory. Our pipeline and backlog continue to grow quarter-over-quarter as we fill our 2025 production slots, and we are doing our level best to keep up with the demand.

Just coming back on automotive margins. I talked about what is happening. One other thing which I want to also share is that we will continue to keep whatever we can, like I said before, while squeezing out the cost. But this is something which we also are very capable of. I mean, just in Q3, we reached our lowest cost per vehicle, and that is a trend which we want to keep focused on.

Then going on to service and other. We continue to show improvements in Q3. This was a result of better performance, both in our service business which includes collision, part sales and merchandise, and continued growth in supercharging. These fleet-based revenues will continue to grow as the overall fleet size increases.

Our operating expenses declined quarter-over-quarter and on a year-on-year basis. This is partially due to the restructuring we undertook in Q2. Cost savings from these initiatives were partially offset by increase in costs related to our AI efforts.

We've started using the GPU cluster based out of our factory house ahead of schedule and are on track to get 50,000 GPUs deployed in Texas by the end of this month. One thing which I'd like to elaborate is that we're being really judicious on our AI compute spend too and thinking how best we can utilize the existing infrastructure before making further investments.

On the CapEx front, we had over $3.5 billion in the quarter. This was a sequential increase largely because of investments in AI compute. We now expect our CapEx for the year to be in excess of $11 billion.

We shared our vision for the future at the We, Robot Event at the beginning of the month. The Tesla team is hyper-focused on delivering on that vision and all efforts are underway to make it a reality.
While we've achieved significant progress this year, it will take time to get this as we pioneer new and incredibly complex technologies and navigate a fragmented regulatory landscape. The future is incredibly bright, and I want to thank the Tesla team once again for all their help.

Question and Answer

Travis Axelrod
Head of Investor Relations

Great. Thank you very much, Vaibhav. Now we'll go to investor questions. The first one is, is Tesla still on track to deliver the more affordable model next year as mentioned by Elon earlier? And how does it align with your AI and product road map?

Lars Moravy
Vice President of Vehicle Engineering

Sure. I mean, as Elon and Vaibhav both said, we are on plan to meet that in the first half of next year. Ambition has always been to lower the cost of our vehicles, to increase the adoption of sustainable energy in transport. Part of that is lowering the cost of our current vehicles, which is where all of the personally-owned vehicles that we sell today come in. But the next stage in that really, as it fits into the AI road map, is when we bring in robotaxis, which lowers the initial cost of getting into an EV. And that's really where we see the marriage of EV road map and the AI road map.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes. It will be like with incentive of sub-$30,000 car, which is kind of a key threshold.

Travis Axelrod
Head of Investor Relations

Great. Thank you very much. Similar question next, when can we expect Tesla to give us the $25,000 non-robotaxi regular car model?

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

We're not making a non-robo.

Lars Moravy
Vice President of Vehicle Engineering

Yes, all our vehicles today are robotaxis.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

So I think we've made it very clear that the future is autonomous. I mean it's going to be -- I've actually said this many years ago, but that my strong belief and I believe that is panning out to be true, certainly, it'd be very obvious in retrospect, is that the future is autonomous electric vehicles. And nonautonomous gasoline vehicles in the future will be like riding a horse and using a flip bone. It's not that there are no horses, yes, there are some horses, but they're unusual. They're niche. And so everything is going to be electric autonomous. I think that it should be, frankly, blindingly obvious at this point that, that is the future.

So a lot of automotive companies or most of the automotive companies have not internalized this, which is surprising, because we've been shouting it from the rooftops for such a long time. And it will accrue to their detriments in the future. But all of our vehicles in the future will be autonomous. All the vehicles that we've really made, almost 7 million vehicles, the vast majority, are capable of autonomy. And we're currently making on the order of 35,000 autonomous vehicles a week. Compare that to, say, Waymo's entire fleet, they've less than 1,000 cars. We're making 35,000 a week.

Vaibhav Taneja

Chief Financial Officer

Yes. And our cars look normal.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes, they mostly look normal. The Cybertruck looks, thankfully, abnormal. And then the Cybercab/ robotaxi, we wanted to have something futuristic-looking, and I think it does look futuristic. And it's worth noting with respect to the Cybercab, it's especially not just a revolutionary vehicle design but a revolution in vehicle manufacturing that is also coming with the Cybercab. The cycle times, like the units per hour of the Cybercab line, like this is just really something special. I mean this will be a half order of magnitude better than other car manufacturing lines, like not even the same league is what I'm saying, not in the same league. And I said like several years ago that maybe the hottest Tesla product probably will be the battery, just like a biofactory.

Lars Moravy
Vice President of Vehicle Engineering

Yes. I can't reverse-engineer a factory.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes. And we're rapidly evolving our manufacturing technology. So anyway, basically, I think having a regular $25,000 model is pointless. It would be silly, like it will be completely at odds with what we believe.

Lars Moravy
Vice President of Vehicle Engineering

In an autonomous world, what matters is the lowest cost per mile of efficiency of that vehicle. And that's what we've done with the robotaxi.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes. Exactly. Autonomous, it's fully considered cost per mile is what matters. And if you try to make a car that is essentially a hybrid, manual/automatic car, it's not going to be as good as a dedicated autonomous car. So yes, Cybercab is just not going to have steering wheels and pedals, it will be designed and optimized for autonomy. It will cost roughly $25,000, so it is a $25,000 car. And you will be able to buy one already exclusively if you want. So it just won't have a steering wheel. You don't need it.

Travis Axelrod
Head of Investor Relations

Great. Thank you very much. The next question is, what is Tesla doing to alleviate long wait times at service centers?

Unknown Executive

So we aim on solving problems at the source, so at the factory, before they can even affect our customers. We believe the best service is no service.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

The car doesn't break. That's the best thing.

Unknown Executive

I don't see anyone with a test. You either fix the issue upstream or do it remotely, do it through software, maybe at work or at home, in a car, and we've addressed and fixed the issue and we've partnered the field with service to make sure we're looking at the same issues. And additionally, just in Q3 and Q4 of this year alone, we have opened and will open in total of nearly 70 locations. And in North America, we significantly expanded the size of each location and have doubled the size last year compared to this year.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes. I think there's like actually a lot of merit to having large service centers because you can have specialization of labor. You can start your approach. Yes, it should be more factory-like where you can have dedicated lanes for particular types of service. And it's way easier for somebody to become expert in a few different types of repairs than in every repair.

Unknown Executive

Exactly. This has helped us with the base of these heavy repairs, like, plugging up a lane. They have dedicated lanes for different type of repairs. And so it's throughput largely, treating it like a factory.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes. This is where a Tesla structure -- I think Tesla has a structural advantage relative to the rest of the auto industry because we make the cars and we service the cars. Whereas I think there's a bit of a conflict of interest with the dealer model, the traditional OEM and dealer model, where the dealerships make most of their money on service. And so they obviously aren't incented to reduce the servicing cost whereas, in our case, we are incented to reduce the servicing cost because we carry that servicing cost. And we've got a good feedback with our cars.

Unknown Executive

I think with the factory, the service leaders together who send people from the factories to the field and field to the factory see it firsthand, provide suggestions for manufacturing as well as for engineering on design.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes. So I view this as a fundamental structural advantage of Tesla versus the rest of the auto industry.

David Lau

We also do a bunch of work on the software side not only to automate diagnostics, so identifying what needs to be done to a car before it comes into service, but also automating all of the preparation work and aligning all the resources that are necessary in order for the car to be very efficiently worked on once it arrives. So the parts are there, like the lift is scheduled, the technician schedule.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes. Like the car will tell you this is what's wrong with me and tells the service center.

Travis Axelrod
Head of Investor Relations

Get everything ready in a minute.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Please fix me and this is what's wrong.

Unknown Executive

Instead of a customer trying to translate, the car is telling us directly, and we're pulling that.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes, most the time, you don't need to diagnose the car when it arrives. This is like, again, a fundamental technology advantage and structural advantage compared to the rest of the auto industry.

Vaibhav Taneja
Chief Financial Officer

I think it's underappreciated as to what all we are able to do. Because like I said before, most of our cars, except for Cybertruck, look the same, right? So people don't realize that it has so much capability.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes. Better than other cars. But they're not like obviously super futuristic.

Travis Axelrod
Head of Investor Relations

Great. Thanks very much. The next question is, please provide an update on the semi. What will the next stage growth look like and when will FSD be ready?

Lars Moravy
Vice President of Vehicle Engineering

Sure. We posted an earnings deck. We're progressing something on the build of the semi factory in our gigafactory in Reno. We've released all our major capital expenditures for that program, and we're on track to start pilot builds in the second half of next year, with production starting in the first half of 2026 and ramping really throughout the year to full production. Semi growth will largely depend on our customers' adoption of the product.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Well, I don't think we're going to be limited, honestly.

Lars Moravy
Vice President of Vehicle Engineering

Yes, which is like a no-brainer for the semi because it's really a commodity of total cost of ownership.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes. Exactly. We have kind of ridiculous demand for the semi.

Lars Moravy
Vice President of Vehicle Engineering

In that world where it's about how much do I spend to [lower] cost per mile, it's a no-brainer.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes. Fundamentally, if you've got a semi, the fully considered cost per mile per ton of transport is better than, say, a diesel truck. Any company that doesn't adopt an electric semi will lose. It's not a subjective thing.

David Lau

It's competitive.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

We want the stat and we want to have a beautiful semi truck. But frankly, if we made an ugly semi truck, would it matter?

Lars Moravy
Vice President of Vehicle Engineering

And this is proving so in our fleets and in Pepsi as a partner. In fact, Pepsi actually said last week that their drivers don't want to go back.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

As soon as we give anyone the electric semi, that's like the choice.

Lars Moravy
Vice President of Vehicle Engineering

It's what they want to drive.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes. So the most senior, their top drivers, well, they get to drive a Tesla semi. It's the thing they want to drive. It's super fun to drive.

Lars Moravy
Vice President of Vehicle Engineering

It's also very easy to drive.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

It's easy to drive and it hauls a**. And it's like fast.

Lars Moravy
Vice President of Vehicle Engineering

Superfast, maybe too fast.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

You've seen like the videos of these electric semis, like they can go uphill, speeding past like the diesel truck.

Lars Moravy
Vice President of Vehicle Engineering

They're racing cars.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes, and cars. So like it's responsive. You floor it and the truck actually moves.

Lars Moravy

Vice President of Vehicle Engineering

And that's a benefit not only for the driver and for the goods but also for safety in terms of other drivers on the road. You don't get stuck behind the semi. You're not like in a slowdown situation in an on-ramp. I mean how that plays into FSD, which is the second part of the question, all of the semis have been -- a couple of hundred we've deployed already. And the ones that we'll be building next year and throughout the future have all of the hardware and the cameras necessary to deploy FSD. And we're currently training with the small fleet that we have. And as soon as the fleet is trained and the neural nets are up, we'll get FSD onto that platform.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes. I mean it would be a massive improvement in driver fatigue and driver safety. We've got sort of the anti-jackknifing software. You don't have to worry about your brakes overheating if you go down a steep hill because that energy goes back into the pack. It's like radically better than a diesel semi. It's why the drivers love it.

Travis Axelrod
Head of Investor Relations

Great. Thank you very much. Our next question is when will Tesla incorporate X and Grok in all the Tesla vehicles?

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

I mean these are relatively small fry things. But yes, I think we'll keep expanding what is available in the car, on the screen and also improving like the browser. So like just generally, you can access anything you want in the car. In fact, for the Tesla, once you get to full autonomy, you actually want fully a system that can do anything. Like, if you want to browse the Internet, if you want to ask AI questions, if you want to watch a movie, if you want to play a video game, if you wanted to do some productivity thing, you can do anything you want in an autonomous vehicle because you don't need to drive. So that's why the Cybercab's got a nice big screen and a great sound system. So you can watch a great movie with it. It's like being in a personal movie theater. It's awesome.

David Lau

Yes. This is why we've been building this functionality, adding gaming to the car, adding movies and other all sorts of different media applications to the car because that's what you're going to -- that's, yes, the cars that will be built today.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Those are really fun games, by the way. People haven't tried it. There's like Castle Doombad and Polytopia and a bunch of really fun games in the car.

David Lau

We're constantly looking at what features to add next and we're paying attention to what's most commonly requested by our customers.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes. I think Castle Doombad.

Travis Axelrod
Head of Investor Relations

Great. Thank you guys very much. The next question is, Elon mentioned unsupervised FSD in California and Texas next year. Does that mean regulators have agreed to it in the entire state for existing Hardware 3 and 4 vehicles?

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

As I said earlier, California loves regulation.

Lars Moravy
Vice President of Vehicle Engineering

But they have a pathway.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes. I mean, there's a pathway. Obviously, Waymo operates in California, so there's just a lot of [forms, spot] and a lot of approvals that are required. I mean I'd be shocked if we don't get approved next year, but it's just not something we totally control. But I think we will get approval next year in California and Texas. And towards the end of the year, we'll branch out beyond California and Texas.

Lars Moravy
Vice President of Vehicle Engineering

I mean I think it's important to reiterate this, like certifying a vehicle at the federal level in the U.S. is done by meeting FMVSS regulations. All our vehicles today that are produced, that are autonomous, are capable to meet all those regulations, the Cybercab and [vehicle] regulations. And so the deployment of the vehicle to the road is not a limitation but is a limitation, as what you said, at the state level where they control autonomous vehicle deployment. Some states are relatively easy, as you mentioned, for Texas. And other ones have pathways like California that may take a little longer. The other ones hadn't set up anything yet. And so we will work on those state by state.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

I do think we should have a federal -- like autonomous vehicles should be approved. It should be possible to do.

Lars Moravy
Vice President of Vehicle Engineering

Congress, if you're listening, let's get the federal AV then.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

There should be a federal approval process for autonomous vehicles. I mean, that's how the FMVSS has started. It's Federal Motor Vehicle. FMVSS is federal.

Unknown Executive

Yes. So I mean in 2017 and '18 was when the regulators started looking at it. It's really kind of stalled since then, but we would appreciate and would support helping out with those regulations.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

It really needs to be like a national approval. It's important. If there's a department of government efficiency, I'll try to help make that moving. I'd do it for every one, not just Tesla. Like some things in the U.S. are state-by-state regulated like, for example, insurance. Like, it's incredibly painful to do it state by state for 50 states. And I think there should be a national approval process for autonomy.

Travis Axelrod
Head of Investor Relations

Great. Thanks, guys. The next question is, what is the plan for 2025?

Vaibhav Taneja
Chief Financial Officer

I mean, basically, we talked through this. There's a lot going on. Elon already mentioned that we're working on cheaper models to come out. I mean there's work which the team is doing to get the factories ready today to try and make that happen.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes. The amount of work required to make a lower-cost car is insanely high. But like it is harder to get like 20% of the cost out of a car than it is to design the car and build the entire factory in the first place. It's like excruciating. And there's not a lot of movies made about the heroes who got 20% of the cost out of a car. But let me tell you, there should be because everything about that is incredibly heroic.

Unknown Executive

It's the little changes.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes. The heroes who got 20% of the cost out of the cars, like, damn, I have all the respect for them. Make a movie. I think you probably could make a compelling movie. If people actually saw how hard it was to do that, they'd be like, "Whoa, that's damn hard."

Unknown Executive

Just yesterday, we were talking about podding.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Honestly, literally, yes. I mean I do call it sort of like getting cost out of things is kind of like a game of pennies. It's like Game of Thrones but pennies. First approximation, if you've got 10,000 items in a car, very rough approximation, and each of them cost $4, then you have a $40,000 car. So if you want to make a $35,000 car, you got to get $0.50 on average out of the 10,000 items.

Unknown Executive

On every part.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes. And then obviously, the best is you delete some parts. In fact, we found we're able to delete a lot of parts. I'm very excited about the Cybercab design and how we're rethinking the design of a car for the Cybercab, designing it while also have volume production, and then design a machine that builds machine that I think is also revolutionary. There's no other car company that's even trying to do what we're doing, like I haven't even heard of it, actually. In fact, I'm certain there isn't one. Like I think our new machine that builds the machine, it's inherent, it's designed to be like 5x better than a traditional factory, like in the cycle time.

Unknown Executive

The cycle time and like part deletion, which I don't think any other car company has the same level of like integration of thought that we have when it comes to like when you design a part from a white sheet

of paper, who's going to make it? Where is it going to be made? How is it going to be shipped? How is it going to be assembled into the vehicle? At any one point, if something is done in the silo, it becomes a bottleneck of either cost or time or efficiency. But with the robotaxi development, like we've done a good job on combining all that and then like blowing up how it's made and saying it should be made this way and rethinking it all, so it's the most efficient factory possible. It will show in our CapEx efficiency when we deploy. It shows in the number of parts. It shows in the simplicity of vehicle, but also how it performs in terms of like end user state.

Vaibhav Taneja
Chief Financial Officer

Just to close out, just on the energy front also in '25, we will have started manufacturing out of the megafactory in Shanghai. We'll continue to increase our overall storage deployments with Powerwall 3. We plan to continue expanding our supercharging network, getting more OEMs on our network. 4680 cell ramp, as Elon talked about, that would keep going. And then also we'll have our lithium refinery starting to produce. So there's a lot which is going on.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes, so many things. The crazy thing is like Tesla is winning basically on almost every single thing we're doing. If we're not running now, we're on track to win. In arenas where there are entire large companies, that's the only thing they do.

Vaibhav Taneja
Chief Financial Officer

Yes. There are multiple companies within the company.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes. Tesla's like many companies in one.

Travis Axelrod
Head of Investor Relations

Fantastic. Thank you, guys. Just a few more, what is going on with the Tesla Roadster?

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Well, I'd just like to thank our long-suffering deposit holders of the Tesla Roadster. The reason it hasn't come out yet is because the Roadster is not just icing on the cake, it's the cherry on the icing on the cake. And so our larger mission is to accelerate the progress towards a sustainable energy future, trying to do things that maximize the probability that the future is good for humanity and for Earth. And so that necessarily means that things like that are deserved. We'd all love to work on the Tesla next-gen Roadster, too, it is super fun, and we are working on it. But it has to come behind more things that have a more serious impact on the good of the world.

So just thank you to all our long-suffering Tesla Roadster deposit holders. And we are actually finally making progress on that, and we're close to finalizing the design on that. It's really going to be something spectacular. A friend of mine, Peter Thiel -- and some of you think that Peter Thiel and I are rivals, we're really good friends. Peter was lamenting how the future doesn't have flying cars. Well, we'll see.

Unknown Executive

More to come.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes.

Travis Axelrod
Head of Investor Relations

Great. Thank you very much. The next one is quite similar to other questions we've had. So I'm going to combine it with the final question. So briefly, could you just detail how robotaxi will roll out? Will it start with a Tesla deployed fleet and then allow customers to add theirs on the subscription model? And then will Hardware 3 be capable of Level 5?

Ashok Elluswamy
Executive Officer

Regarding the Hardware 3, what we saw with Level 5 was it was easier to make progress starting with Hardware 4 and figuring out the solution and back-porting it to Hardware 3 instead of directly working on Hardware 3 given that Hardware 4 has more like fundamental hardware capabilities. I think that trend will continue into the next few quarters as well where we first figure out the solution rapidly with AI4 and then back-port it, write the kernels, and it just takes longer to develop those things because it's not fundamentally supported in the hardware and it's emulated. But yes, it's initially working on Hardware 4, back-porting it to Hardware 3.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes. So I guess the answer is we're not 100% sure, but as Ashok mentioned, because by some measure hardware 4 has really several times the capability of Hardware 3, it's easier to get things to work with Hardware 4 and then it takes a lot of effort to sort of squeeze that functionality into Hardware 3. And there is some chance that Hardware 3 does not achieve the safety level that allows for unsupervised FSD. There is some chance of that. And if that turns out to be the case, we will upgrade those who have bought Hardware 3 FSD for free. And we have designed the system to be upgradeable, so it's really just sort of switch out the computer type of thing. The cameras, they're capable. But we don't actually know the answer to that. But if it does turn out, we'll make sure we take care of those who have bought FSD on Hardware 3.

Travis Axelrod
Head of Investor Relations

Great. And in the last few minutes that we have left, we will try to get in some analyst questions. The first question will be coming from Pierre Ferragu at New Street.

Pierre C. Ferragu
New Street Research LLP

I was wondering about like the compute you're ramping up. So you gave like interesting statistics on how much you have and you said you don't feel you're compute constrained. And I was wondering how you are putting to work this additional compute. Is that a game for you of creating like larger and larger models, like next-generation of models that are larger the way OpenAI go from GPT-3 to GPT-4? Or is that more like you're set on your model and you need to throw more and more compute to accelerate the pace of learning to improve reliability?

And then I had a quick follow-up really quick on your rollout in Texas and in California next year. The plan, as you see it today, is it to roll out like a fleet or 2 with a car that will start with like some onboard supervision, someone sitting at the wheel just in case and removing the supervisors progressively? Or are you aiming for going fully fledged without even a human supervisor when you get started?

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Okay. Well, I guess I'll answer the first part of the question, the nature of real-world AI is different from, say, LLM in that you have a massive amount of context. So like you've got a case of Tesla 7 or 8 cameras,

up to 9 if you include the internal camera, so you've got gigabytes of context. And that is then distilled down into a small number of control outputs, whereas it's like very rare to have. In fact, I'm not sure any LLM out there can do gigabytes of context. And then you've got to then process that in the car with a very small amount of compute power. So it's all doable and it's happening, but it is a different problem than what, say, a Gemini or OpenAI is doing.

Now part of the way you can make up for the fact that the inference computer is quite small is by spending a lot of effort on training. And just like a human like you, the more you train on something, the less amount of workload it takes when you do it. The first time a human starts driving, it absolves your whole mind. But then as you train more and more on driving, get very good, then the driving becomes a background task. It only absorbs a small amount of your mental capacity because you had a lot of training. So we can make up for the fact that the inference computers is tiny compared to a 10-kilowatt bank of GPUs because you've got a few hundred watts of inference compute. We can make up for that with heavy training.

And then there's also vast amounts -- the actual petabytes of data coming in are tremendous. And then sorting out what training is important. Of the vast amounts of video training or video data coming into the fleet, what is actually most important for training? That's quite difficult. But as I said, we're not currently training compute constraint.

Ashok, do you want to elaborate?

Ashok Elluswamy
Executive Officer

Like you mentioned, the training helps both train large models, also train quicker. But in the end, we still got to pick which models are performing better. So the validation effort to picking the models because the miles per intervention is pretty large, we had to drive a lot of miles and go in closed loop. We do have simulation and other ways to get those metrics. Those do help. But in the end, that's a big bottleneck. That's why we're not training compute constraint alone. And there's other access of scaling as well, which is the data, figuring out which data is more useful. That is an important aspect and we're focusing on that.

Lars Moravy
Vice President of Vehicle Engineering

Yes. So as it relates to the second part of your question, Pierre, about safety drivers and rolling it out, each state has different requirements in terms of how many miles and how much time you need to have a safety driver and not have a safety driver. We're going to follow all those. We're not going to violate whatever regulations are out there with safety as a priority. But the goal is obviously that when we're ready and safety is there, we'll remove all the drivers from the ride-share.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes. I mean, I guess like we think that we'll be able to have driverless Teslas during paid rides next year, sometime next year.

Travis Axelrod
Head of Investor Relations

Thank you. And our next question comes from Adam Jonas at Morgan Stanley.

Adam Michael Jonas
Morgan Stanley, Research Division

I just had a question about the relationship between Tesla and xAI. Many investors are still not clear how the work at xAI is truly beneficial to Tesla. Some even take the view that the 2 companies may even be in competition with each other in terms of talent and tech and even your time, Elon. So what's your message to investors on that relationship between Tesla and xAI? And where do you see it going over time?

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Well, I should say that xAI has been helpful to Tesla AI quite a few times in terms of things like scaling up, bot it, like training, just even like recently, in the last week or so, improvements in training where, if you're doing a big training on one and it fails, being able to continue training and easy to recover from a training one. xAI has been pretty helpful. But there are different problems. xAI is working on artificial general intelligence or artificial super intelligence. Tesla is trying to make autonomous cars and autonomous robots. They're different problems.

Vaibhav Taneja
Chief Financial Officer

I think we've said this before also, like not all AI is equal, right? I mean AI is a broad spectrum. And we have our own swim lanes. Yes, there are certain things which we can collaborate on if needed, but for the most part, we're solving different issues.

Elon R. Musk
Co-Founder, Technoking of Tesla, CEO & Director

Yes. Tesla is focused on real-world data. And as I was saying earlier, it is quite a bit different from LLM because you have massive context in the form of video and some amount of audio that's going to be installed with extremely efficient inference compute. I do think Tesla is the most efficient in the world in terms of inference compute. Because of necessity, we have to be very good at efficient inference. We can't put 10 kilowatts of GPUs in a car. We've got a couple of hundred watts. And it's a pretty well-designed Tesla AI chip, but it's still a couple of hundred watts.

But they are different problems. I mean it's not that xAI is like we're just running inference. I mean it is running inference and answering questions, answering Tesla's questions on a 10-kilowatt rank. It's like you can't put that in a car. It's a different problem.

So xAI, they felt there wasn't a truth-seeking digital super intelligence company out there, like that's what it came down to. They needed to be truth-seeking, an AI company that is very rigorous about being truthful. I'm not saying xAI is perfect, but that is at least the explicit aspiration. Even if something is politically incorrect, it should still be truthful. I think this is very important for AI safety.

So I think xAI, it has been helpful to Tesla and will continue to be helpful to Tesla, but they are very different problems. I mean like what other car company has a world-class chip design team? Like zero. What other car company has a world-class AI team like Tesla does? Zero. Those are all startups that were created from scratch.

Travis Axelrod
Head of Investor Relations
Great. Thank you, Elon. And I think that's, unfortunately, all the time that we have for today. We appreciate all your questions. And we look forward to hearing from you next quarter. Thank you very much, and goodbye.