TSLA Earnings Call – FY2024 Q4

Date: January 29, 2025

Operator

Good afternoon, everyone and welcome to Tesla's Fourth Quarter 2024 Q&A Webcast. My name is Travis Axelrod, the Head of Investor Relations here at Tesla, and I am joined today by Elon Musk and Vaibhav Taneja and a number of other executives. Our Q4 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. During the question-and-answer portion of today's call, please limit yourself to one question and one follow-up. Please use the raise hand button to join the question queue. Before we jump into Q&A, Elon has some opening remarks. Elon?

Elon Musk

Thank you. So, in summary, in Q4, we set a record and delivered vehicles at an annualized rate of nearly 2 million a year. So, congratulations to the Tesla team on excellent work, achieving record production and deliveries. Model Y was the best-selling vehicle of any kind for 2024. That's worth noting. Not just the best electric vehicle, the best vehicle of any kind on earth, number one was Model Y. We're staying focused on maximizing volumes and obviously doubling down for, I don't know what, it really, I was going to say doubling down on autonomy, but really it's like autonomy is like 10x-ing. Frankly, doubling is not even enough. We made many critical investments in 2024 in manufacturing AI and robotics that will bear immense fruit in the future, immense. Like it's, in fact, to such a scale that it is difficult to comprehend. And I've said this before, and I'll stand by it. I see a path, I'm not saying it's an easy path, but I see a path for Tesla being the most valuable company in the world by far, not even close. Like, maybe several times more than, I mean, there is a path where Tesla is worth more than the next top five companies combined. There's a path to that. I mean, I think it's like an incredibly, just like a difficult path, but it is an achievable path. So -- and that is overwhelmingly due to autonomous vehicles and autonomous humanoid robots. So, our focus is actually building towards that. And that's where we're laying the ground. We laid the ground work for that in 2024. We'll continue to lay the ground work for that in 2025. In fact, more than laid the groundwork actually, so it would be building the structure, it'd be we're building the manufacturing lines and like -- like, setting up for what I think will be an epic 2026 and a ridiculous '27 and '28. Ridiculously good. That is my prediction. As yet, very few people understand the value of Full Self Driving and our ability to monetize the fleet. I've -- some of these things I've said for quite a long time and I know people said, well, Elon is the boy who cried wolf like several times but I'm telling you there's a damn wolf this time and you can drive it. In fact, it can drive you. It's a self-driving wolf. For a lot of people, like their experience of Tesla autonomy is like, if it's even a year old, if it's even two years old, it's like meeting someone when they're like a toddler and thinking that they're going to be a toddler forever. But obviously they're not going to be a toddler forever if they grow up. But if their last experience was like, FSD was a toddler, it's like, well, it's grown up now. Have you seen it? It's like walks and talks. And that's really what we've got. And it's difficult for people to understand this because human intuition is linear as opposed to what we're seeing is exponential progress. So, that's why my number one recommendation for anyone who doubts is simply try it. Have you tried it? When's the last time you tried it? And the only people who are skeptical, the only people who are skeptical are those who have not tried it. So, a car goes -- a passenger car typically has only about 10 hours of utility per week out of 168. A very small percentage. Once that car is autonomous, my rough estimate is that it is in use for at least a third of the hours of the week. So, call it 50, maybe 55 hours of the week. And it can be useful both for cargo delivery and people delivery. So, even let's say people are asleep, but you can deliver packages in the middle of the night or resupply restaurants or whatever the case may be, whatever people need at all hours of the day or night. That same asset, the thing that these things that already exist with no incremental cost change, just a software update, now have five times or more the utility than they currently have. I think this will be the largest asset value increase in human history. Maybe there's something bigger, but I just don't know what it is. And so people who look in the rearview mirror are looking for past precedent, except I don't think there is one. So -- but the reality of autonomy is upon us. And I repeat my advice, try driving the car or let it drive you. So, now it works very well in the US, but of course it will over time work just as well everywhere else. So, we're working hard to grow our annual volumes. Our constraint this year -- our current constraint is battery packs this year, but we're working on addressing that constraint. And I think we will make progress on addressing that constraint. And then things are really going to go ballistic next year, and really ballistic in '27 and '28. So, yeah. So, a bit more on Full Self Driving. Our Q4 Vehicle Safety Report shows continued year-over-year improvement in safety for vehicles so that the safety numbers, if somebody has supervised Full Self Driving turned on or not, the safety differences are gigantic. So, and people have seen the immense improvement with Version 13 and with incremental versions in Version 13 and then Version 14 is going to be yet another step beyond that that is very significant. We launched the Cortex training cluster at Gigafactory Austin, which was a significant contributor to FSD advancement, and we continue to invest in training infrastructure out of Texas headquarters. So, the training needs for Optimus or Optimus humanoid robot are probably at least ultimately 10x of what's needed for the car, at least to get to the full range of useful roles. You can say, how many different roles are there for a humanoid robot versus a car? Humanoid robot has probably, well, 1000 times more uses and more complex things than in a car. That doesn't mean the training scales by a 1000, but it's probably 10x. Now you can do this progressively. So it doesn't mean like, or Tesla is going to spend like $500 billion in training compute. Because we obviously train Optimus to do enough tasks to match the output of Optimus robots. And obviously, the cost of training is dropping dramatically with time. So, it is one of those things where I think long-term, Optimus will be -- Optimus has the potential to be north of $10 trillion in revenue. Like, it's really bananas. So that you can obviously afford a lot of training compute in that situation. In fact, even $500 billion training compute in that situation would be quite a good deal. Yeah. The future's going to be incredibly different from the past, that's for sure. We live at this unbelievable inflection point in human history. So, yeah. So, the proof is in the pudding. So, we're going to be launching unsupervised Full Self Driving as a paid service in Austin in June. So -- and I've talked with the team. We feel confident in being able to do an initial launch of unsupervised, no one in the car, Full Self Driving in Austin in June. We already have Tesla's operating autonomously unsupervised Full Self Driving at our factory in Fremont and we'll soon be doing that at our factory in Texas. So, thousands of cars every day are driving with no one in them at our Fremont factory in California. They will soon be doing that in Austin and then elsewhere in the world for the rest of our factories which is pretty cool. And the cars aren't just driving to exactly the same spot because obviously it all, [went and collide] (ph) at the same spot. The cars are actually programmed with what lane they need to park in to be picked up for delivery. So, they drive from the factory end of line to their specific - to their destination parking spot and then could be picked up for delivery to customers and then doing this reliably every day, thousands of times a day. It's pretty cool. Like I said, the Teslas will be in the wild with no one in them, in June in Austin. So, what I'm saying is this is not some far-off mythical situation. It's literally, five, six months away, five months away kind of thing. And while we're stepping into -- putting our toe in the water gently at first, just to make sure everything's cool, our solution is a generalized AI solution. It does not require high precision maps of a locality. So we just want to be cautious. It's not that it doesn't work beyond Austin. In fact, it does. We just want to be, put a toe in the water, make sure everything is okay, then put a few more toes in the water, then put a foot in the water with safety of the general public and those in the car as our top priority. With regard to Optimus, obviously I'm making these revenue predictions that sound absolutely insane. I realize that. But they are, I think, they will prove to be accurate. Yeah. Now, with Optimus, there's a lot of uncertainty on the exact timing, because it's not like a train arriving at the station for Optimus. We are

designing the train and the station and in real time while also building the tracks. And so they're like, people shouldn't say like, why didn't the train arrive exactly at 12:05? We're literally designing the train and the track and the station in real time while you're saying, how can we predict this thing with absolute precision? It's impossible. The normal internal plan calls for roughly 10,000 Optimus robots to be built this year. Will we succeed in building 10,000 exactly by the end of December this year? Probably not, but will we succeed in making several thousand? Yes, I think we will. Will those several thousand Optimus robots be doing useful things by the end of year? Yes, I'm confident they will do useful things. The Optimus in use at the Tesla factories, production design one, will inform how - what we change for production design two, which we expect to launch next year. And our goal is to ramp prompt Optimus production faster than maybe anything's ever been ramped. Meaning, like aspirationally an order of magnitude ramp per year. Now, if we aspire to an order of magnitude ramp per year, perhaps we only end up with a half order of magnitude per year. But that's the kind of growth that we're talking about. It doesn't take very many years before we're making 100 million of these things a year. If you go up by, let's say, a factor, by 5x per year, insane. Not 50%, 500%. So, these are big growth numbers. Yeah. But we do need to be -- this is an entirely new supply chain, is entirely new technology. There's nothing off the shelf to use. We try desperately with Optimus to use any existing motors, any actuators, sensors, nothing worked for our humanoid robot, at any price. We had to design everything from physics first principles to work for a humanoid robot and with the most sophisticated hand that has ever been made before, by far. And Optimus will be able to like play the piano and be able to thread a needle. I mean this is the level of precision no one has been able to achieve. And so it's really something special. So, yeah, so -- and my prediction long term is that Optimus will be overwhelmingly the value of the company. Regarding energy, back to Earth. Mr. Elon, can you come back here for a minute? Okay, back to Earth. Energy storage is a big deal and will become, it's already super important, will become incredibly important in the future. And it is something that enables far greater energy output to the grid than is currently possible. Because the grid, the grids are -- the vast majority of the grid has no energy storage capability. So, they have to design the power plants to, for very high peaks and assuming that there's no energy storage. Once you have grid energy storage and home-based energy storage, the actual total energy output per year of the grid is dramatically greater than people think. Maybe it's at least double. This will drive the demand of stationary battery packs, and especially the grid scale ones, to insane, basically as much demand as we could possibly make. So, we have our second factory, which is in Shanghai, that's starting operation and we're building a third factory. So we're trying to ramp output of the stationary battery storage as quickly as possible. Now, there is a challenge here where we have to be careful to that we're not robbing from one pocket to take to another pocket because for a given gigawatt hours per year of the cell output, we have to say, does it go into stationary applications or mobile applications? It can't go both into both. So, we have to make that trade-off. Yeah. But overall, the demand for total gigawatt hours of batteries, whether mobile or stationary, that will grow in a very, very big way over time. So, in conclusion, 2025 really is a pivotal year for Tesla. And when we look back on 2025 and the launch of unsupervised Full Self Driving, true real-world AI that actually works, I think they may regard it as the biggest year in Tesla history, maybe even bigger than our first car, the Roadster or the Model S, so the Model 3 or Model Y. In fact, I think it probably will be viewed '25 as maybe the most important year in Tesla's history. There is no company in the world that is as good at real-world AI as Tesla. I don't even know who's in second place. Like, you say like who's in second place for real-world AI. I would need a very big telescope to see them. That's how far behind they are. All right.

Travis Axelrod

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

Vaibhav Taneja

Yeah, I'll talk about things on Earth. As Elon mentioned, in Q4, we set records in vehicle deliveries and energy storage deployments in an uncertain macro environment. We were able to grow auto and energy storage volumes both sequentially and on a year-on-year basis. For this, I would like to thank the efforts of everyone at Tesla to make this a reality and our customers who helped us achieve this feat. Coming into the fourth quarter, our focus was to reduce inventory levels in the automotive business and we accomplished that by ending the quarter with the lowest finished good inventory in the last two years. This was a result of offering not only attractive financing options but also other discounts and programs which impacted ASPs. While we saw volume growth in almost all regions that we operate in, we hit a new record for deliveries in the Greater China market. This is an encouraging trend since we grew volume in a highly competitive BEV market. On the automotive margin front, we saw a quarter-over-quarter decline primarily due to lower ASPs and due to the recognition of FSD related revenue in Q3 from feature releases. Our journey on cost reduction continues, and we were able to get our overall cost per car down below $35,000, primarily by material costs. This was despite increased depreciation and other costs as we prepare for the transition to the new Model Y for which we recently started taking orders in all markets. All our factories will start producing the new Model Y next month while we feel confident in our team's abilities to ramp production quickly, know that it is an unprecedented change and we are not aware of anybody else taking the best-selling car on the planet and updating all factories at the same time. This changeover will result in several weeks of lost production in the quarter. As a result, margins will be impacted due to idle capacity and other ramp related costs, as is common in any launch, but will be overcome as production is ramped. We will be introducing several new products throughout 2025. We are still on track to launch a more affordable model in the first half of 2025 and will continue to expand our lineup from there. From a dollar-for-dollar basis, we believe we have the most compelling lineup today compared to the industry, and it will continue to get better from here. As always, all our products come with the best software in the industry, autonomy features and capable of full autonomy in the future. And despite the premium experience, the total cost of ownership is close to mass market, less premium competitors. Energy storage deployments reached an all-time high in Q4, and this -- and resulted in -- but declined sequentially. This was a result of higher -- sorry, growth came from Megapack and Powerwall. Both businesses continue to be supply constrained, and like Elon mentioned, we're trying to ramp up production with Megafactory Shanghai coming online this quarter onwards. While quarterly deployments will likely continue to fluctuate sequentially, we expect at least 50% growth in deployments year-over-year in 2025. Gross profit and margins in the service and other business was up year-over-year but declined sequentially. This was the result of higher service center costs and lower profit from used car business. The businesses within service and other primarily support our new car business, especially through their impact on total cost of ownership. Therefore, while we manage them to be positive on a GAAP basis, we do not expect similar margins as the rest of the business. There's a lot of uncertainty around tariffs. Over the years, we've tried to localize our supply chain in every market, but we are still very reliant on parts from across the world for all our businesses. Therefore, the imposition of tariffs, which is very likely, and any [Indiscernible] will have an impact on our business and profitability. Our operating expenses grew both year-over-year and sequentially. The biggest driver of the increase was R&D as we continue to invest in AI-related initiatives. The remaining increase came from growth in our sales capabilities and marketing efforts from referral program. For 2025, we expect operating expenses to increase to support our growth initiatives. It is important to point out that the net income in Q4 was impacted by a $600 million mark-to-market benefit from Bitcoin due to the adoption of a new accounting standard for digital assets, whereby we will change -- we will take mark-to-market adjustments through other income every reporting period going forward. Our free cash flow for the quarter was $2 billion, and despite CapEx increase of over $2.4 billion in 2024, we were able to generate free cash flow of $3.6 billion for the year. CapEx efficiency is something we are extremely focused on. While we have invested in AI-related initiatives, we have done so in a very targeted manner to utilize the spend to get immediate benefits. The build-out of Cortex was accelerated because of the role -- actually to accelerate the rollout of FSD Version 13. Accumulative AI-related CapEx, including infrastructure, so far has been approximately $5 billion. And for 2025, we expect our CapEx to be flat on a year-over-year basis. In conclusion, like Elon said, 2025 is going to be a pivotal year for Tesla. There are a lot of investments which we have made and will continue to make in this coming year, which will set the pace for the next phase of growth. And it is something which now I'm getting out of earth, it is going to be out of this world. And we just are putting the right

foundation. And that's all I have.

Travis Axelrod

Great. Thank you very much, Vaibhav. Now, we will move over to investor questions and we'll start with say.com. The first question is, is unsupervised FSD still planned to be released in Texas and California this year? What hurdles still exist to make that happen? You addressed the Texas piece, I think, already, so...

Elon Musk

Yeah, I'm confident that we'll release unsupervised FSD in California this year as well. Yeah, in fact, I think we will most likely release unsupervised FSD in many regions of the country of the US by the end of this year. Like I said, we're just putting our toe in the water, then a few toes, then a foot, then leg, then make sure everything is cool. And we're looking for a safety level that is significantly above the average human driver. So, it's not anywhere like much safer, not like a little bit safer than human, way safer than human. So the standard has to be very high because the moment there's any kind of accident with an autonomous car, this immediately gets worldwide headlines, even though about 40,000 people die every year in car accidents in the US, and most of them don't even get a mention anywhere. But if somebody scrapes a shin with an autonomous car, it's headline news.

Vaibhav Taneja

We want to avoid that.

Elon Musk

Yeah. So it's really from an -- the only thing holding us back is an excess of caution. But people can certainly get a feel for how well the car would perform as unsupervised FSD by simply having a car, allowing the car to drive you around your city and see how many times did you have to intervene. Not where you wanted to intervene or were a little concerned. But how many times did you have to intervene for, for definite safety reasons. And you will find that that is currently very rare, and over time, almost never.

Travis Axelrod

Great. Thank you very much. The next question is, are there any discussions with other auto companies about licensing FSD?

Elon Musk

Yes. What we're seeing is, at this point, significant interest from a number of major car companies about licensing for Tesla Full Soft Driving technology. What we've generally said is the best way to know what to do is take one of our cars apart, and then you can see where the placement of the cameras are, what the thermal needs are of the Tesla AI inference computer. That's better than us sending some CAD drawings. And then we're only going to entertain situations where the volume would be very high, otherwise it's not worth the complexity. And we will not burden our engineering team with laborious discussions with other engineering teams until we obviously have unsupervised Full Self Driving working throughout the United States. I think the interest level from other manufacturers to license an FSD will be extremely high once it is obvious that unless you have FSD, you're dead.

Travis Axelrod

Great. Thank you very much. The next question is, is Optimus now mostly design locked for 2025 production?

Elon Musk

Optimus is not design locked. So, when I say like we're designing the train as it's going to -- we're redesigning the train as it’s going down the tracks while redesigning the tracks and the train stations.

Vaibhav Taneja

Every [indiscernible].

Elon Musk

Yeah, it's rapidly evolving. It's rapidly evolving in a good direction. It's pretty damn amazing actually. Team’s doing a fantastic job. We really have, by far, I think by far the best team of humanoid robotics engineers in the world. And we also have all the other ingredients necessary, because you need a great battery pack, you need great power electronics, you need great charging capability, you need great communications, great Wi-Fi and cellular connectivity. And of course, you need real-world AI. And then the ability to scale that production to huge levels. So you have to design for manufacturing. The things that, really what other companies are missing is they're missing the real-world AI and they're missing the ability to scale manufacturing to millions of units a year.

Vaibhav Taneja

I think that is an underappreciated thing that industrialization of design is a whole different thing than making a design.

Elon Musk

Yeah, prototypes are trivial basically. Prototypes are easy, production is hard. I've said that for many years. The problem is that there's like, those who have never been involved in production or manufacturing somehow think that once you come up with some eureka design that you magically can make a million units a year. And this is totally false. There needs to be some Hollywood story where they show actually the problem is manufacturing. I've never even heard of one. It just doesn't fit the narrative. The Hollywood thing is like it's like some lone inventor in a garage goes Eureka and suddenly it files a patent and suddenly there's millions of units. I, like, I'm listening to guys who were missing most really 99% of the story. 1% is another old saying of one person -- like a product is 1% inspiration 99% perspiration. The Hollywood shows you 1% inspiration and minus, but forgets about the 99% perspiration of actually figuring out how to make that

initial prototype manufacturable and then manufactured at high volume such that the product is reliable, low cost, consistent, doesn't break down all the time, and that is 100 times harder, at least, than the prototype.

Vaibhav Taneja

Then you have to get it there, deliver it, I think, yeah.

Elon Musk

Yeah, you have to meet all these regulations, and there's a million regulators around the world, it's pretty difficult.

Travis Axelrod

Great, thank you. The next question is also Optimus related. When will Tesla start selling Optimus, and what will the price be?

Elon Musk

Well, the -- it may -- for this year we expect to just close the loop with Optimus being used internally at Tesla, because we obviously can easily use several thousand humanoid robots at Tesla for the most boring, annoying tasks in the factory, like the tasks nobody wants to do, where we have to like beg people to do this task. And then they -- then it's like the robot's totally happy to do the boring, dangerous, repetitive task that no humans want to do. And that's also actually some of the easiest use cases for us to have Optimus do things like load the hopper, like, say you're loading the body line if you're transporting pieces of sheet metal to the robot, which is already robot, the robot welding line for the body, and you just have to nonstop take things out of a, from one fixture to another fixture. And it's a very boring job That's the kind of thing what the Optimus could do.

Vaibhav Taneja

The guy who runs around all the wall studs and the pins.

Elon Musk

Yeah, there's a ton of boring jobs, tedious jobs, dangerous, slightly dangerous jobs that are perfect for Optimus. So we expect to use Optimus for those tasks at our factories and that'll help us close loop for improvement this year. It really was the production Version 2 which I think launches sometime next year. I'd like it to be the beginning of next year but maybe it's more like the middle of next year. And then we have to -- with a production line that is designed for -- on the order of 10,000 units a month versus 1,000 units a month. So, when you're designing a production line for 1,000 units a month, it takes you a while to actually reach anywhere close to 1,000 units a month. For any given production output, it takes a while to actually reach its potential. The current line that we're designing is for roughly 1,000 units a month of Optimus robots. The next line would be for 10,000 units a month. The line after that would be for 100,000 units a month. And I think probably with Version 2, it is a very rough guess because there's so much uncertainty here, very rough guess that we start delivering Optimus robots to companies that are outside of Tesla in maybe the second half of next year, something like that. But like I said, this is such an exponential ramp that it will go from no one's receiving humanoid robots to these things like coming out like crazy.

Vaibhav Taneja

We can't build enough.

Elon Musk

We're always going to be in a we can't build enough situation. Demand will not be a problem even at a high price. And then as I said, like, once we start -- once we're at a steady state of above 1 million units a year, I think the production -- I'm confident at 1 million units a year, that the production cost of Optimus will be less than $20,000. If you compare the complexity of Optimus to the complexity of a car, so just the total mass and complexity of Optimus is much less than a car. So, I would expect that at similar volumes to say the Model Y, which is over 1 million units a year, that you'd see Optimus be, I don't know, half the cost or something like that. What the price of Optimus is a different matter. The price of Optimus will be set by the market demand.

Travis Axelrod

Great. Thank you very much. The next question is, what is the status on mass production of the Tesla Semi? And how will it impact revenue and scale?

Lars Moravy

I can take that one. So, we just closed out the Semi factory roof of walls last week in Reno, a schedule, which is great with the weather. In Reno, you never know what's going to happen. But we're prepping for mechanical installation of all the equipment in the coming months. The first builds of the high volume Semi design come late this year in 2025 and begin ramping early in 2026. But as we've said before, the Semi is a TCO, no-brainer. I think it's really similar to Optimus, set by how much people pay and it has the total cost of ownership, it's much, much cheaper than any other transportation you can have. So at that point, when we're at scale, it will meaningfully contribute to Tesla's revenue. I think it’s difficult to say how much. Anything you want to add Elon?

Elon Musk

No. I mean, I do think that Tesla Semi, again with autonomy, is going to be incredibly valuable. That we actually have a shortage of truck drivers in America, that's one of the limiting factors on transport. And people are human so they get tired and sometimes there's -- it's -- I have a lot of respect for truck drivers because it's a tough job. But because it's a tough job, there's not that many people that want to do it. And there's actually fewer -- I believe, if my saying is correct, there are a few people entering truck driving as a profession than are not leaving it.

Vaibhav Taneja

Yes.

Elon Musk

So when you think, yeah, exactly. So when you consider, okay, there's more people leaving truck driving as a profession than entering it, well, we're going to have a real logistics problem as time goes by. So autonomy will be very important to meet that need. So like, yeah, it will -- I don't know. It's a several billion a year opportunity, which I don't know in this context. Is that -- these days, does several billion a year matter? I think it does. It's not nothing. It's probably -- it might -- it's probably like a $10 billion a year thing. That's $1 billion a month at some point probably. But it's -- all this is going to pale in comparison to Optimus. So yeah, $1 billion a month is a lot but it's not -- it's going to be like 1% of Optimus.

Travis Axelrod

Great. Thank you very much. We already covered the next question in opening remarks, so moving on. Is it expected that Tesla that will need to upgrade Hardware 3 vehicles? And if so, what is the timeline and expected impact to Tesla's CapEx? I think they are referring to cost there.

Elon Musk

They're really asking the tough questions, aren't they?

Vaibhav Taneja

I guess we reached -- we haven't started working on Hardware 3 yet. We are still making software releases. We released the 12.6 release recently, which was like a -- is like a baby V13, but it's a significant improvement compared to what they had previously. And people are still finding ways, there are still larger motors in the smaller models. So we don't give up on Hardware 3, we're still working on it. Just the releases will trail the Hardware 4 releases.

Travis Axelrod

Great. Thanks.

Elon Musk

Yeah. I mean, I think the honest answer is that we're going to have to upgrade people's Hardware 3 computer for those that have bought Full Self Driving, and that is the honest answer and that's going to be painful and difficult but we'll get it done. Now, I'm kind of glad that not that many people bought the FSD package.

Travis Axelrod

Thanks, Elon. The next question. Has Tesla given up on ramping their solar roof product?

Elon Musk

No, we -- sorry, Mike, go ahead, yeah.

Unidentified Company Representative

Yes, I can take it. Yeah, solar roof is a core part of the residential product portfolio and it still remains. It draws a lot of customer interest despite it being premium products. We've worked on multiple iterations of engineering to make the product easier to install and distribute by reducing SKU count. And more recently, rather than direct installation, we are focused on growth through our nationwide network of certified installers. And many of those, they've been installing solar roof for many years.

Elon Musk

That's actually turned out to be a much better way for the -- like it's just let the roof -- just supply products to the roofing industry. And especially when somebody's is getting a new roof anyway or building a house from scratch, obviously, this is by far the most efficient time to put in a solar roof as opposed to putting a solar roof on a house that -- where the roof still has 20 years of life. That's not economically senseful. But if it's a new house or the roof needs to be replaced anyway, then solar roof can make a lot of sense. And it is a premium product. It's like the Model S, Model X or something, like it's a premium product. I think it looks really cool. And you -- I mean, your house generates electricity. And if you combine it with the Tesla Powerwall battery, then you can be self-sufficient. So, even if the grid turns off, even if the grid turns off for several days, your house still works, and your roof looks awesome. So, it's like, I recommend anyone who had -- who can afford it, get the Tesla solar roof and the Powerwall. Your family's life might depend on it. And just in terms of convenience, your kids are not going to yell at you because their computers don't work because power went out and you can't charge your phone. Actually happens. Yeah. You literally can't even call anyone because your phones out of juice.

Travis Axelrod

Thank you very much. The next question was covered in opening remarks, so we will skip that. And the last question from say.com. What technical breakthroughs will define V14 of FSD, given that V13 already covered photon to control?

Elon Musk

Well, we're going to help a lot -- help a lot further than [indiscernible] We've been in sort of the nothing but nets situation, nothing but neural nets from photons to controls for a while now for just improving the neural nets. I guess we could get into some of the technical details to some degree. I have to say I continue to be amazed by just how effective order aggressive transformers are at solving a wide range of problems. I mean, Ashok, is there anything you'd like to add there without giving away the sort of family secrets?

Ashok Elluswamy

I mean, except for things we put on X already. Yeah, it's continuing to scale the model size a lot. We scale a bunch in V13, but then there's still room to grow. So we're going to continue to scale the model size. We're going to increase the context length even more. The memory is sort of limited right now. We want to increase the amount of memory, also give to even minutes of context for driving. We're going to add audio and emergency vehicles better, add data of the tricky common cases that we get from the entire fleet, any interventions or any kind of user intervention. We just add that to the data, the dataset. So the scaling in basically every axis, training compute, data set size, model size, model context, and also all the reinforcement learning objectives.

Travis Axelrod

Great. Alrighty. With that, we will move over to analyst questions. So just as a reminder, you will need to unmute yourself to ask your question and the first question will be coming from Daniel Roeska from Bernstein. Daniel, please go ahead and unmute yourself.

Daniel Roeska

Hey, good evening, everybody. It's Daniel from Bernstein. Elon, Tesla's share price clearly already includes quite few of the anticipated benefits you talked about today, yet realizing what you call kind of difficult but achievable will take some time. What are you pushing the Tesla executive team to do differently now to accelerate the innovation in order to realize the value you described for the company.

Elon Musk

Well, I mean, we're, I think, working on perfecting real-world AI and making rapid progress week over week, if not month, certainly month over month, but often week over week. I spent a lot of time with the Tesla AI team and the Tesla Optimus team. I mean, I go where the problem is essentially. Like, not -- if something's, this is, unfortunately sometimes, like, don't talk to Tesla executives, and like, hey, we don't see you very often. I'm like, that's because your stuff is working awesome. If you start working really great, unfortunately, I didn't see them very often because I go where the problem is. So, [indiscernible] what's the greatest challenge that lies ahead? So obviously there are many challenges with Optimus. It's a hard problem to solve. Many challenges with vehicle autonomy. But we're making rapid progress in both. Yeah.

Daniel Roeska

Okay. I mean, it sounds like you've got a conviction that the pieces you need, right, are in place. If we kind of go 12 months down the line and we look back, and you had some of those, but maybe what are the kind of two or three KPIs that would tell you that you're on track and it's going the right way and the pieces you've put in place are the right pieces, right? That's kind of what I'm looking for or other way around, where would it be off most likely in your mind that you say, hey, I need to go back there and I need to change something to enable the team better?

Elon Musk

Well, I mean, I think my predictions that I'm making here are going to be pretty accurate. And it's worth the next -- sometimes people say, Elon's always late. Well, actually, no, the problem is that the media reports on when I'm late, but never reports when I'm early. So sure, I'm optimistic, but I'm not that optimistic. There are many cases in the past where I actually, we've been early, such as completion of the Shanghai factory or factory completion has generally have been ahead of schedule, not behind. So, yeah, so the -- but I like to say I'm very confident we'll have released unsupervised Full Self Driving fully autonomous Teslas in Austin and several other cities in America by the end of this year. That's probably everywhere in America next year, and everywhere in North America at least. I think in terms of next year our constraints, I think it's likely to be just regulatory. Like Europe really has, for example, Europe is a layer cake of regulations and bureaucracy, which really needs to be addressed. There's this joke like America innovates, Europe regulates. It's like, guys, there's too many refs on the field. I mean, for example, for us to just to release supervised Full Self Driving in Europe, even though it works really well, we have to go through a mountain of paperwork with the Netherlands, which is our primary regulatory authority. Then the Netherlands presents this to the EU and I think May. And there's like this big EU country committee. We expect it to be approved at that time, but there's nothing we can do to make that may happen sooner. In fact, nobody seems to do it. But I guess all the countries would have to somehow vote in some way to have it happen sooner than May. Otherwise, it won't happen sooner than May. So then when is unsupervised FSD allowed in Europe? I'm like, May next year maybe? I don't know. I have to find out when the EU is meeting again. Sometimes it's a 12-month cadence, sometimes a six-month cadence. Then in China, which is a gigantic market, we do have some challenges because they weren't, currently allow us to transfer training video outside of China. And then the US government wouldn't let us do training in China. So we're in a bit of a bind there. So like, bit of a quandary. So we are already solving then is by literally looking at videos of streets in China that are available on the Internet to understand and then feeding that into our video training so that publicly available video of street signs and traffic rules in China can be used for training and then also putting it in a very accurate simulator. And so it will train using SIM for bus lanes in China. Like bus lanes in China, by the way, were about the biggest challenges in making FSD work in China is the bus lanes are very complicated. And there's like literally like hours of the day that you're allowed to be there and not be there. And then if you accidentally go in that bus lane at the wrong time, you get an automatic ticket instantly. So, it's kind of a big deal, bus lanes in China. So we're going to put that into our simulator, train on that. The car has to know what time of day it is, read the sign. Anyway, we'll get this solved. But I think we'll have unsupervised FSD in almost every market this year limited simply by regulatory issues, not technical capability. And then unsupervised FSD in the US this year, in many cities, but nationwide next year. And hopefully we have unsupervised FSD in most countries by the end of next year. That's my prediction with the best data that I have right now.

Travis Axelrod

Great. Thank you very much. The next question will come from Adam Jonas at Morgan Stanley. Adam, please feel free to unmute yourself.

Adam Jonas

Thanks everybody. So, Elon, you've said in the past about LiDAR, for AVs at least, that LiDAR is a crutch, a fool's errand. I think you even told me once, even if it was free, you'd say you wouldn't use it. Do you still feel that way?

Elon Musk

Yes.

Adam Jonas

Care to elaborate or just, I have another question.

Elon Musk

Look, we even have a radar in the car and we turned it off.

Adam Jonas

I got it. All right. So you're still -- people think you're crazy for not looking to LiDAR.

Elon Musk

Obviously humans drive without shooting lasers out of their eyes. Unless you're Superman. But like humans drive just with passive visual, humans drive with eyes and a neural net and a brain neural net. So the digital equivalent of eyes and a brain are cameras and digital neural nets or AI. So that's the entire road system was designed for passive optical neural nets. That's how the whole road system was not designed and what everyone's expecting, that's how we expect other cars to behave. So therefore that is very obviously the solution for Full Self Driving in it as a generalized, but the generalized solution for Full Self Driving as opposed to the very specific, neighborhood by neighborhood solution, which is very difficult to maintain, which is what our competitors are doing.

Adam Jonas

I got it.

Elon Musk

Yeah. I mean, LiDAR doesn't work in the fall, guys. LiDAR has a lot of issues. I don't have to like, the SpaceX Dragon docks with the space station using LiDAR that a program that I've personally spearheaded. I don't have some fundamental bizarre dislike of LiDAR. It's simply the wrong solution for driving cars on roads.

Adam Jonas

Right. You understand how light are works. I get it.

Elon Musk

Literally designed and built our own red LiDAR. I oversaw the project, the engineering thing. It was my decision to use LiDAR on Dragon and I oversaw the engineering project directly. So I'm like we literally designed and made a radar, a LiDAR to dock with the space station. But if I thought it was the right solution for cars, I would do that, but it isn't.

Adam Jonas

Yeah. All right. Just as a follow up. At CES, you said, I'm paraphrasing, that any AI will be able to do any cognitive task not involving atoms within the next three or four years. And that would imply, Elon, that before the end of President Trump's term in office, that AI would be moving pretty damn quickly into the physical world, into the world of photons and atoms. And I'm thinking, given your work with the administration, how confident are you that the US will have the manufacturing and the supply base to make good on your excitement about physical AI by the end of -- by latter this decade. We seem pretty vulnerable right now. I've seen you tweeting about, or sorry, X-ing, excuse me, Elon, about China, Freudian slip, about China having like making more drones in a day than the US makes in a year and all the entanglement of the supply. So, what has to happen in the US to make that possible? What's your message and what can what can you do about it and what's relevant for Tesla shareholders? Thanks, Elon.

Elon Musk

Well, at Tesla, obviously, we think manufacturing is cool. SpaceX, we think manufacturing is cool. But in general, for talented Americans, they need to be beyond, beyond my companies, beyond me and my teams here, in general, we need to make manufacturing cool again in America. And, like, I honestly think people should move from like law and finance into manufacturing. That's my honest opinion. We have too much, this is both a compliment and a criticism. We have too much talent in law and finance in America. And there should be more of that talent in manufacturing. So, yeah. The potential for the future. I mean, it tells that we're making sure that we can continue to manufacture our stuff. Even in the event of geopolitical tensions rising to very high levels.

Adam Jonas

Great. Thank you very much. The next question will come from Pierre Ferragu at New Street. Pierre, please feel free to unmute yourself.

Pierre Ferragu

Hey, thanks guys for taking the question. So, I have a question on deploying like robotaxis in June in Austin. So that's great news. And I was wondering if it means I can drive down to Austin in June and try unsupervised by myself with my car, or it's going to be more like your fleet testing it?

Elon Musk

It'll be our fleet testing it. That's our sort of toe in the water. We'll be scrutinizing it very carefully, make sure it's not something we missed. But it will be, autonomous ride-hailing for money in Austin in June. And then as shortly as possible other cities in America. And I expect us to be operating, doing unsupervised activity with our internal fleet in several cities by the end of the year. Then it's probably next year when people are able to add or subtract their car from the fleet.

So, kind of like Airbnb where you can sort of add or subtract your house or your guest room, you can say like add it to the Airbnb inventory or don't add it to the Airbnb inventory. If you're traveling for a month, or whatever, in case maybe you can, that other people use your house. Anyway, that's probably next year because we want to just make sure we've ironed out any kinks. And a lot of it is, it's not like we're not splitting the atom here. It's just a bunch of work that needs to be done to make sure the whole thing works efficiently, that people can order the car. It comes, it's the right spot, does exactly the right thing. All the payment systems work. The billing works.

Pierre Ferragu

Yeah. Okay. But then, like, so my follow-up question would be, I have a Tesla, I have a FSD, and I have to keep my eyes on the road all the time. It's super boring because I don't really need to intervene anymore. And the really annoying thing is that I can't just check my emails. And so are you working also on introducing, like a kind of like free and supervised where I could be eyes off and I would be able to check my email and we just need to, with a five second notice, have to go back and keep an eye on what's happening or is that something you're working on as well? Because it feels so close with this certain that I wonder if it's something you'd expect for this year. It's a very sensitive question. I asked for myself to be honest.

Elon Musk

Yes, we just need -- we need to be very confident that the probability of injury is low before we allow people to check with their email and text messages. In fact, right now we're in this perverse situation, which you may have encountered yourself where people will actually go to manual driving to check their text messages so the computer doesn't yell at them and then go then put it back on autonomous mode once they have checked the text messages, which is obviously less safe, significantly less safe, significantly less safe than just letting people check their text once in a while without the computer yelling at them. But we just want to be cautious about the advent that we're in this sort of, neither here nor there, but just for, I mean, I think it's not for many months longer. But yeah, we're in this perverse situation where people will turn the car off autopilot so the computer doesn't yell at them, check the text messages while steering the car with their knee and not looking out the window.

Ashok Elluswamy

And like Elon said, if you have any problems with the system and when people are not looking, that is a dangerous thing. And that's what we're trying to avoid. The capability is getting there, but it's not fully there. That's why he was using the term of tipping a toe in the water, then getting comfortable, then keeping going.

Elon Musk

Yeah. Anyway, it's not far off. But we would not want to prove to ourselves and also prove to regulators that the car is unequivocally safer in autonomous mode than not. And that's, we're not far off. So, this is like low single-digit months.

Ashok Elluswamy

To the safety aspect, we did publish our Vehicle Safety Report today. And then Q4 is one crash for every 5.9 million miles driven compared to a crash every 700,000 miles without…

Elon Musk

We're getting to the point where it's an order of magnitude.

Ashok Elluswamy

Yeah, it's like 8.5 times safer. So it's just about there. It's amazing.

Travis Axelrod

Great. Alrighty. And our last question will be coming from Dan Levy at Barclays. Dan, feel free to unmute yourself.

Dan Levy

Great. Good evening. Thank you for taking other questions. Elon, you've talked about the need for proliferation of sustainable transport in the past as part of sort of broader push to sustainable energy. Look, I know we've heard a lot about President Trump's plans to reverse the EV Mandate and I think there's a view that given regulation is a driver of EV uptake, this could slow EV uptake in the US. So, what would be your view on the right policy in the US, given your comments in the past of the need to push for sustainable transport?

Elon Musk

At this point, I think that sustainable transport is inevitable. I'm highly confident that all transport will be autonomous electric, including aircraft, and that it simply, it can't be stopped any more than one could have stopped the advent of the external combustion engine, steam engine, or one could have stopped the advent of the internal combustion engine. Like, even if you've been the biggest [indiscerinble] advocate on earth, like courses of the way, not these newfangled car automobiles, you can't stop the advent of automobile. It's going to happen. And you can't stop the advent of electric cars. It's going to happen. The only thing holding back electric cars was range, and that is the sole problem.

Dan Levy

Great. And then as a follow up, in the past, Elon, you had made a comment that, you'd be willing to sell cars at effectively no margin to get the cars out there. And there's a comment in the release today of the rate of acceleration of autonomy efforts does impact volume growth. So perhaps you could just talk about, with your efforts on FSD, how we should think about your desire to put more vehicles out in the market to take advantage of your tech advances.

Elon Musk

So, I'm not sure I understand the question. We have a lot of cars. I mean, we've got millions of cars out there.

Vaibhav Taneja

So, is your question, Dan, that how do we marry our future growth aspects with FSD?

Travis Axelrod

Go ahead and unmute yourself, Dan.

Dan Levy

Yeah. More so just how much more aggressively you would be willing to sell your cars versus in light of your improvements on FSD.

Elon Musk

Well, right now, the constraint we're trying to solve is battery production as opposed to demand. So, there are -- now Q1, we've got this massive factory retooling for the new Model Y, for example. That obviously has a short-term impact on output. But the problem we are seeing with, in fact, we're talking that the executive team and I were talking about just before this call was we've got to figure out how to increase total gigawatt hours of battery production this year one way or another. That's the constraint on our output.

Travis Axelrod

Great. Alrighty. And with that, I think we are all done for today. So, thanks, everyone, so much for all your questions. We look forward to talking to you next quarter. Thank you very much, and goodbye.