Q3 2022 Earnings Call

Company Participants

- Andrew Baglino, Senior Vice President, Powertrain and Energy Engineering
- Elon Musk, Chief Executive Officer
- Martin Viecha, Vice President of Investor Relations
- Zachary Kirkhorn, Chief Financial Officer

Other Participants

- Adam Jonas, Analyst, Morgan Stanley
- Colin Langan, Analyst, Wells Fargo
- Colin Rusch, Analyst, Oppenheimer
- George Gianarikas, Analyst, Canaccord Genuity
- Pierre Ferragu, Analyst, New Street Research
- Toni Sacconaghi, Analyst, Bernstein
- William Stein, Analyst, Truist

Presentation

Martin Viecha {BIO 17153377 <GO>}

Good afternoon, everyone, and welcome to Tesla's Third Quarter 2022 Q&A Webcast. My name is Martin Viecha, VP of Investor Relations. And I'm joined today by Elon Musk, Zachary Kirkhorn, and a number of other executives. Our Q3 results were announced at about 3:00 PM Central Time in the update deck we published at the same link as this webcast.

During the 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 Q&A session 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.

But before we jump into Q&A, Elon has some opening remarks. Elon?

Elon Musk {BIO 1954518 <GO>}

Thank you, Martin. So just to do a Q3 recap. Q3 was another record quarter on many levels. We had our industry leading operating margin reach 17% and our free cash

flow surpassed $3 billion in Q3 and approached $9 billion in the past 12 months. As our factories ramp, we're looking forward to a record breaking Q4. So it really, knock on wood, it looks like we'll have an epic end of year. So Q4 is looking extremely good.

On the production ramp, Giga Berlin achieved another milestone of 2,000 cars made in a week with very good quality, and is ramping rapidly. Giga Austin or Giga Texas should reach this milestone very soon. And in fact, just yesterday, we extrapolated yesterday's build rate, it would be 2,000. Our production of 4680 cells has tripled in Q3 compared to the previous quarter. We are finally gaining rapid traction on the 4680 cell. And its output is growing rapidly and we expect it to start incorporating in cars and having it be a significant portion of our production here in Texas in the coming months.

We also have our second-generation of manufacturing equipment for 4680 cells in Texas, which continues to show great progress along with our original pilot line in Fremont. The Fremont factory team once again reached record production in Q3 and we intend to keep raising production in Fremont.

Regarding Autopilot, at the end of -- at the end of September, we hosted our second AI Day and drove the first prototype of our Optimus robot, released updates on our Dojo training computer and high range of improvements of full self-driving software. Our vehicles have now driven nearly 60 miles in full self-driving beta mode, and this number continues to grow exponentially. Our goal with that AI Day was to post recruiting, and we've seen a massive influx of world-class artificial intelligence engineer and scientist resonate. So it generated a tremendous amount of interest from some of the best AI researchers in the world. I can't emphasize the importance of this enough, because I think finally has become clear to the smallest AI technologists in the world that Tesla is among the very best.

So this quarter, we expect to go to wide release of full self-driving beta in North America. So anyone who has ordered a full self-driving beta -- full self-driving will have access to the FSD beta program this year, probably about a month from now. So -- and then obviously, new -- anyone who buys a car and purchase a full self-driving option will immediately have that available to them. So the safety that we're seeing when the car is in FSD mode is actually significantly greater than the safety we're seeing when it is not, which is a key threshold for going to a wide beta.

Let's see with respect to demand. We've got a lot of questions about demand in recent weeks. I can't emphasize enough, we have excellent demand for Q4 and we expect to sell every car that we make for as far in the future as we can see. So the factories are running at full speed and we're delivering every car we make and keeping operating margins strong. We are still a very small percentage of the total vehicles on the road. Of the 2 billion 1,000 trucks on the road, we only have about 3.5 million. So we've got a long way to go to even reach 1% of the global fleet.

Let's see kind of based on my -- what people -- based on many things, but certainly questions I get on Twitter about buybacks. And I think every one of our Board members has gotten questions about buybacks. We've debated the buyback idea extensively at the Board level. The Board generally thinks that it makes sense to do a buyback but we want to work through the right process to do a buyback. But it's certainly possible for us to do a buyback on the order of $5 billion to $10 billion. Even in the downside scenario next year, even if next year is a very difficult year, we still have the ability to do a $5 billion to $10 billion buyback. This is obviously pending Board review and approval. So it's likely that we'll do some meaningful buyback.

So in conclusion, while the market teams revolve around the short-term, it's very important to focus on the long-term. I can't emphasize this enough with investors and I think long time investors, obviously recognize it with Tesla. We have our sort of local ups and downs, but long-term trend has been extremely good. And several years ago, I said I think on our earnings call that I thought it was possible for Tesla to be worth more than Apple, which was then the highest cap company I think in the market. And Apple at that time, I think it was around $700 billion. And I said required incredible execution, at least some luck, and we didn't only achieve that. Tesla went, in fact, or passed Apple's market cap time.

And now, I'm of the opinion that we can far exceed Apple's current market cap. In fact, I see a potential path with Tesla to be worth more than Apple and Saudi Aramco combined. So now that doesn't mean it will happen or that will be easy. In fact, I think it will be very difficult. It will require a lot of work, some very creative new products, manage the expansion and always a luck. But for the first time, I am seeing -- I see a way for Tesla to be, let's say, roughly twice the value of Saudi Aramco. I think that's -- I haven't quite seen that yet. I mean this is the first time I've seen that potential. So we have an incredible product portfolio. I think we've got the most exciting product portfolio of any company on earth, some of which you've heard about, some of which you haven't. We're in the final lap for Cybertruck. We building a Cybertruck line here at Giga Texas, Austin and making a lot of progress in the Robotaxi platform design.

And then with respect to batteries, we're moving as fast as possible to have -- to achieve 1,000 gigawatt hours a year of production capacity in the United States vertically integrated. And our cap load lithium refining, we're moving at top speed to do that. So I think it's an incredibly exciting future and really an unprecedented future. None of this would be possible without the incredible team that we have here at Tesla. So I'd like to give a huge shout out to all of our factory employees, engineers, executives and the whole Tesla team. You guys rock. You're the ones that make it happen. Thank you. Thank you, everyone

Martin Viecha {BIO 17153377 <GO>}

Thank you very much. And Zach has some opening remarks as well.

Zachary Kirkhorn {BIO 20940148 <GO>}

Yeah. Thanks, Martin. Just to continue on Elon's theme, just want to thank and congratulate the Tesla team for achieving record vehicle deliveries, production and storage deployments in the third quarter.

On automotive profitability, our GAAP operating margin was 17.2% with automotive gross margin at 27.9%. Operating margin is one of our best yet with improvements in operating leverage. However, Austin and Berlin ramp costs weighed on our margins particularly if you compare it to Q1. Removing regulatory credits and Austin and Berlin, our operating margins would have been our strongest yet and auto gross margin would have been nearly 30%. Note that while small and growing each car we build in Austin and Berlin is contributing positively to profitability.

We also continue to experience margin headwinds associated with macroeconomic conditions as we've discussed at length on prior calls, in particular raw materials, logistics and foreign exchange was a big part of this past quarter.

On Energy profitability, we achieved our strongest gross profit yet for this business, driven primarily by record volumes of our Megapack and Powerwall products. Our free cash flows were also a record despite an increase in cars in-transit at the end of the quarter which has a negative impact on working capital. Specifically, on cars in-transit, as noted in our press release on October 2, we've started to experience limits on outbound logistics capacity which we didn't anticipate. This issue is particularly precedent for ships from Shanghai to Europe and local trucking within certain parts of the US and Europe.

Our historical operating pattern of batch building by delivery region leads to extreme concentrations of outbound logistics needs in the final weeks of each quarter. Just to put this in perspective, roughly two-thirds of our Q3 deliveries occurred in September and one-third in the final two weeks. As a result, we've begun to smooth the regional builds throughout the quarter to reduce our peak needs for outbound logistics. We expect this to simplify our operations, reduce costs and improve the experience of our customers.

As we look ahead, our plans show that we're on-track for the 50% annual growth in production this year, although we are tracking supply chain risks which are beyond our control.

On the delivery side, we do expect to be just under 50% growth due to an increase in the cars in-transit at the end of the year, as noted just above. This means that again, you should expect a gap between production and deliveries in Q4, and those cars in-transit will be delivered shortly to their customers upon arrival to their destination in Q1.

Austin and Berlin ramp costs will continue to weigh on margins, although we expect the impact to be less than what we saw in Q3. And as Elon mentioned, we're continuing to build as many cars as possible while also maintaining strong operating margins. Thank you.

Questions And Answers

A - Martin Viecha {BIO 17153377 <GO>}

Thank you very much. And let's go first through the shareholder questions. The first shareholder question is, given the stringent battery content and assembly requirements for consumer tax credit eligibility under the Inflation Reduction Act, can you speak to Tesla's ability to meet those thresholds in each of 2023, 2024, and 2025 with your existing and planned supply chain?

A - Elon Musk {BIO 1954518 <GO>}

Well, yeah, I mean I think just high level I'll say, we do expect to fully meet the IRA's requirements. Do you want add?

A - Zachary Kirkhorn {BIO 20940148 <GO>}

Yeah. We view that passing of the Inflation Reduction Act as a significant boost towards accelerating automation, while also scaling the battery supply chain at large in the United States. We expect Treasury to publish detailed guidance by the end of the year. Until such time, it's difficult to fully determine the eligibility criteria, but we believe Tesla is very well positioned to capture a significant share of that for solar storage and also electric vehicles.

A - Elon Musk {BIO 1954518 <GO>}

Yeah, I'd like to -- we're -- like I said earlier, we're going to go basically pedal to the metal as fast as humanly possible to get to 1,000 gigawatt hours a year of production in the US vertically-integrated.

A - Martin Viecha {BIO 17153377 <GO>}

Thank you. Let's go to the next question. The next question is, what updates can you offer on the backlog and recent order intake trends, especially outside of the US and especially in China?

A - Elon Musk {BIO 1954518 <GO>}

Well, it's -- there's definitely -- China is experiencing a reverse of a recession of sorts, which is property market, simply growing from a property market mostly. And Europe has recession of sorts driven by energy. The US actually is in pretty good -- North America is in pretty good health. The Fed is raising interest rates more than they should, but I think they'll eventually realize that and bring back down again.

So yeah, demand is a little harder than it would otherwise be. But as I said earlier, we are extremely confident of a great Q4, and we anticipate continuing to grow our vehicle production sales deliveries by -- on average 50% a year as far into the future as we can see.

A - Martin Viecha {BIO 17153377 <GO>}

Thank you.

A - Elon Musk {BIO 1954518 <GO>}

Actually one caveat, I should say, growing production by 30% every year, because deliveries -- we try to smooth out the deliveries and not have those crazy delivery weighing in at the end of every quarter. So in fact we're just fundamentally running out of -- there weren't enough boats, there weren't enough trains, there weren't enough car carriers to actually support the wave. Has it got too big? So whether we like it or not, we actually have to smooth out the delivery of cars intra-quarter because there just aren't enough transportation objects to move them around.

A - Martin Viecha {BIO 17153377 <GO>}

Thank you. The next question is, do you still expect 50% annualized growth for the foreseeable future? Is this also true specifically for the Chinese domestic market? Do you expect to need to cut vehicle prices or offer incentives in any market to sustain demand, or has demand remained stable or is even rising? You've got a few questions there.

A - Elon Musk {BIO 1954518 <GO>}

So like I said, we wanted to sort of focus on a high-level on what we think is possible here we -- to best to our knowledge, we believe that Tesla will continue to grow deliveries and revenue production at 50% or greater compound annual growth rate. It might occasionally be a year that is a little less and then some years will be maybe a little more or a lot more. Some of our out year planning we see potential annual growth rates that are in excess of 50%.

A - Martin Viecha {BIO 17153377 <GO>}

Thank you. The next question is, can you tell us more about the product feature roadmap beyond new models and FSD, and especially for interior and powertrain of existing vehicle models?

A - Elon Musk {BIO 1954518 <GO>}

Yeah. We could, but we wont. Sorry guys, we can't like jump again on future product announcements.

A - Zachary Kirkhorn {BIO 20940148 <GO>}

Committed to continuing to support.

A - Elon Musk {BIO 1954518 <GO>}

Yes, we obviously are -- yes. First, (inaudible). But we'll also be committed to continuous growth. Yeah, at Tesla, we've always been committed to continuous improvement. So as friends of mine have asked me like, when should I buy a car, I'm like now because we just keep improving the cars.

A - Zachary Kirkhorn {BIO 20940148 <GO>}

It's always the latest Tesla.

A - Elon Musk {BIO 1954518 <GO>}

Yeah, there's still the latest Tesla. So I don't really -- yeah -- in order to every now and again we do have some big technology upgrade like Plaid. And by the way, I think the Plaid Model S and X are the best cars on earth. There's nothing even close, in my opinion. Just try one. Epic.

A - Martin Viecha {BIO 17153377 <GO>}

Thank you. The next question is, we keep hearing of dire energy crisis in Germany this winter. What are Tesla's plans to combat power cuts? And will there be any delays in ramp-up in production from Giga Berlin because of this?

A - Zachary Kirkhorn {BIO 20940148 <GO>}

Yeah, I can take that. I think two points on this question. The first just that based upon everything that we know, we don't see this as a large risk to the company. Even if production did go down for a period of time, this is on near-term, it doesn't have any impact on the long-term of the company.

A - Elon Musk {BIO 1954518 <GO>}

But we don't -- we're not -- we have no indication whatsoever that we will have to cut our production in Germany.

A - Zachary Kirkhorn {BIO 20940148 <GO>}

No. And we put in place backup plans and we're working through the supply chain as well. Nearly all of our suppliers are prepared as well. So we'll see how this plays out, but it's not something that we're terribly worried about.

A - Martin Viecha {BIO 17153377 <GO>}

Thank you. And the next question is, how is production planning going for the Cybertruck? What is the initial Phase 1 production target? When can we expect an update on pricing and final design?

A - Andrew Baglino {BIO 21161872 <GO>}

Yeah. I mean, as Elon said earlier, we'd be on product -- so these preparations here in Giga Texas for Cybertruck. We're still on track to enter early production in the middle of next year. We started our beta builds of all of the battery body in the existing... (Multiple Speakers)

A - Elon Musk {BIO 1954518 <GO>}

When should I drop my beta?

A - Andrew Baglino {BIO 21161872 <GO>}

In a few weeks. (Multiple Speakers) And that's going well, and we continue ramping up through the end of next year and into 2023.

A - Elon Musk {BIO 1954518 <GO>}

Great. Yeah, the car is going to be sick and sick. That is going to be a hall of famer next level. Sorry, it took it longer than expected, but there were a few things that got in the way, like insane global supply chain shortages like FedEx, yeah, which are force majeures if they ever or other one.

A - Martin Viecha {BIO 17153377 <GO>}

Right. Thank you.

A - Elon Musk {BIO 1954518 <GO>}

Of course. There's Tesla Semi, of course. So we'll be handing over our first production Tesla Semis to Pepsi on December 1. I'll be there in person. And we will begin ramping up production of the Tesla Semi which is a max load, heavy truck. That's a Class A truck, Class A truck.

A - Zachary Kirkhorn {BIO 20940148 <GO>}

No sacrifice to cargo capacity.

A - Elon Musk {BIO 1954518 <GO>}

Yeah, no -- exactly, very important, no sacrifice to cargo capacity, 500 mile range. Just to be clear, 500 miles with the cargo. Yeah, 500 miles with the cargo on level ground. Yeah, sure. Not up. It's excellent. But the point is it's a long-range truck and even with heavy cargo. And the number of times people talk you know you can't -- it's impossible to make a long-range heavy-duty Class A truck. And then I'll ask, well, what are your assumptions about what hour kilogram and what hours per mile, and they look at me with a blank stare and then say, hydrogen.

I'm like, no, that's not the answer. I was looking for numbers, literally. It's not a number. It's (inaudible) table. You obviously don't need hydrogen for heavy trucking, so point I wanted to make here. And we'll be ramping up Semi production through next year. As I think everyone knows at this point, it takes about a year to ramp up production. So we expect to see significant -- we're tentatively aiming for 50,000 units in 2024 for Tesla Semi in North America. And obviously, we'll expand beyond North America. And these would sell -- I don't want to say the exact prices, but they're much more than a passenger vehicle. So with a few thousand heavy trucks of this nature would be worth several Model Ys.

A - Martin Viecha {BIO 17153377 <GO>}

Thank you. The next question is, what is the progress of the 4680 cell ramp? And what factors determine whether vehicles get 2170s versus 4680 cells? And how will

that change in the next year?

A - Zachary Kirkhorn {BIO 20940148 <GO>}

Yeah, ramp is going well, as Elon said. Total output is up 3x quarter-over-quarter and production is tracking to exceed 1,000 car sells per week this quarter as we said on last quarter. Our focus is now shifting from 100% ramp to cost and further expanding production capacity in North America, as Elon also mentioned.

On the 2170 versus 4680, in our factories we really attempt to minimize factory complexity and product changeover, while still making sure we get enough new product into the field to learn how it is performing. And that sort of mix is going to shift as 4680 scales here and the overall factory ramp proceeds in Texas.

A - Elon Musk {BIO 1954518 <GO>}

Right. But basically, in nutshell 4680 ramp is growing exponentially. And yeah, it's going well. We're just looking good. This is just going to be a very major backlog in the future. (Multiple Speakers)

And like I said, we're -- our goal is to strive towards 1,000 gigawatt hours a year of annualized production in United States alone by Tesla, not including its products [ph]. (inaudible) will be on top of that.

A - Andrew Baglino {BIO 21161872 <GO>}

We need to get 300 to 400 terawatt hours built to accomplish our goal.

A - Elon Musk {BIO 1954518 <GO>}

Yeah, there's roughly -- to transition to sustainable energy, our rough calculation for both stationary and vehicles is 300,000 to 400,000 gigawatt hours or 300 to 400 terawatt hours.

A - Andrew Baglino {BIO 21161872 <GO>}

So when you're like 1 terawatt, it sounds like a lot. Well, a lot of terawatt hours to go.

A - Elon Musk {BIO 1954518 <GO>}

Yeah. And just on the cathode side, the main cathode we think will probably be iron and most of the irons as iron can scale to very, very high tonnage and then some nickel. The exact percentages are hard to figure out, but it's probably be same as much iron cathodes as they go or even more. And then there's the manganese wildcard as well. (inaudible)

A - Zachary Kirkhorn {BIO 20940148 <GO>}

No. And on that note, we're pursuing aggressively North American iron cathode supplies. And have -- yeah, we can talk more about that at a future date.

A - Elon Musk {BIO 1954518 <GO>}

Yeah.

A - Martin Viecha {BIO 17153377 <GO>}

All right. Thank you. The next question was on the Semi truck, which we already addressed. So I'm going to skip to the next one. Can you talk about how Tesla could adjust if we were to enter a prolonged recession, including new product prioritization, investment flexibility, new factory versus factory expansion, service support infrastructure, productivity cost measures and demand stimulation alternatives?

A - Elon Musk {BIO 1954518 <GO>}

Well, to be frank, we're very pedal to the metal, come rain or shine. So we are not reducing our production in any meaningful way, recession or not recession. So...

A - Zachary Kirkhorn {BIO 20940148 <GO>}

It's the 1% locking in.

A - Elon Musk {BIO 1954518 <GO>}

Yeah, exactly. So I think the public, at large, realizes that everyone's moving towards electric vehicles and that it's foolish to actually buy a new gasoline car at this point, because the residual value of that gasoline car is going to be very low. So I think we have to be in a very good spot. But I wouldn't say it's recession proof, but it's certainly recession resilient, because basically, it has -- people both have large part made the decision to move from gasoline cars to electric cars.

And then in transitioning a healthy generation to sustainable, you need solar and wind with the stationary battery pack to buffer the power. So you have 24/7 power because the wind doesn't go time and sun doesn't travel time. So that also is -- we actually see the energy storage business, stationary storage growing more like 150% to 200% a year, but much faster than cars by a lot.

A - Zachary Kirkhorn {BIO 20940148 <GO>}

And sorry, just to add before you jump in, Martin. Just to echo Elon's point, I mean, I think where our cash balance is, what our forecasted cash generation is, where our margins are as a company, I mean we can withstand quite a lot of downside before we would have to dig into our capital plans, Supercharger expansion, product lineup. So the business has done quite well over the last handful of quarters. And this is a real opportunity I think for the company to fast forward in a most aggressive way as Elon has mentioned.

A - Elon Musk {BIO 1954518 <GO>}

Yeah. We try to model out like, let's say, 2023 is a brutal recession year. Even then, we generate meaningful cash. Once you get out of that potentially forward plus its

insane.

A - Martin Viecha {BIO 17153377 <GO>}

Great. Thank you very much. And let's go to the last investor question, which is, the progression from Tesla's first platform with SMX to the second platform with 3 and Y led to 50% reduction in cost of goods sold. When do you see Tesla's third platform being released? And what level of cost of goods sold reduction could you achieve?

A - Elon Musk {BIO 1954518 <GO>}

Well, we don't want to talk exact dates, but this is a -- I mean, the primary focus of our new vehicle development team, obviously. We've -- at this point, we've done the engineering for Cybertrucks and for Semi. And so it's obviously against what we're working on, which is the next-generation vehicle, which will be probably about the cost of 3 and Y platform. It will be smaller to be clear. But it will, I think, certainly become -- certainly exceed the production of all our other vehicles combined.

A - Zachary Kirkhorn {BIO 20940148 <GO>}

I mean, obviously, we're going to take everything we learned from S, X, 3 and Y, Cybertruck and Semi and pour it into that platform. But we -- as you've said to us many times, we're on a two-for-one target. So you know that we (inaudible) we're trying to get to that 50% number again.

A - Elon Musk {BIO 1954518 <GO>}

It's like, we're going to take two. If that's exactly what our plans drives, (inaudible). Now we make two cars for the amount of effort that it currently takes us to make one Model 3.

A - Zachary Kirkhorn {BIO 20940148 <GO>}

Yeah, effort costs.

A - Elon Musk {BIO 1954518 <GO>}

Those things considered.

A - Zachary Kirkhorn {BIO 20940148 <GO>}

(Multiple Speakers) Half the loss, half the past, half the factory floor space. We're twice the output.

A - Elon Musk {BIO 1954518 <GO>}

And we do believe this can be done. By the way, I should mention that when I said that probably now that I see a path in extremely -- very difficult path, incredible execution required, a massive amount of hard work and some luck to get to where Tesla is worth as much as Apple and Saudi Aramco combined, I wasn't including Optimus.

A - Martin Viecha {BIO 17153377 <GO>}

Thank you. Let's go to analyst questions next. The first question comes from Adam Jonas from Morgan Stanley. Adam, go ahead and unmute.

Q - Adam Jonas {BIO 3339456 <GO>}

Great. Can you hear me?

A - Martin Viecha {BIO 17153377 <GO>}

Yeah.

A - Elon Musk {BIO 1954518 <GO>}

Yeah.

Q - Adam Jonas {BIO 3339456 <GO>}

So Elon, would you consider vertically integrating into mining? That's my first question.

A - Elon Musk {BIO 1954518 <GO>}

We'll do whatever we have to. Whatever limiting factor is, we'll do. We do not personally constrain ourselves. We don't particularly integrate just for the hell of particularly integrating. Like if there was a great supplier who's better than us or we think at least is very good, or even where the economics of comparative advantage suggests that we should use that supplier, even if we could beat them, but we could use our resources to do something else that will be more productive, then we would in source in that case. But if we have to go mine, we will mine.

Q - Adam Jonas {BIO 3339456 <GO>}

Okay. Thanks, Elon. My follow-up is 1 terawatt hour of manufacturing in the United States vertically integrated. I guess my question is what would need to change with US permitting laws to allow that? Kind of what would be your message to this administration or next? And, do you think you could do a terawatt hour? What's the going price of that? Can you do that for under $100 billion bucks in the states? Thanks.

A - Elon Musk {BIO 1954518 <GO>}

Well, I mean, I think the message to the government would be that there should be -- I should say, we've actually had conversations with a number of senior government leaders, White House, Congress and whatnot. And the suggestion that we have is that there should be an expedited permitting process for anything which is critical to a sustainable energy future. So it doesn't make sense to put like a coal mine and a sustainable energy battery like lithium mine in the same category. Coal, does not have any future, lithium does.

And by the way, you can extract lithium with almost no disturbance to the local environment. So it's not actually ugly, nasty find situation. So I would recommend expedite permitting would really be helpful. Basically, a fast track environmentally, I think a sense fast track things that are important for the environment and the communities (inaudible). That seems logical. And the reception has been positive, so we'll see if something happens with that.

I think probably on this earnings call, we're not ready to go into financial details of the -- what will take to get there. But what we are seeing is practical improvements as we redesign the whole supply chain and all of the elements that go into a battery cell. We're seeing -- we're figuring out dramatic efficiencies. And I think we'll -- net result which would be that the capital required to achieve that level of output will be much less than what people think.

A - Martin Viecha {BIO 17153377 <GO>}

Thank you very much. Let's go to the next question from Colin Langan from Wells Fargo. Colin, go ahead and unmute. Colin, can you click unmute?

Q - Colin Langan {BIO 15908877 <GO>}

You hear me now?

A - Martin Viecha {BIO 17153377 <GO>}

Yeah, we can hear you.

Q - Colin Langan {BIO 15908877 <GO>}

Okay. Sorry about that. Any update on full self-driving? I think you had said a couple of quarters ago, would be available by the end of the year. Is that still possible? Is it -- would it still be like a Level 4 or Level 5 that you're talking about? And are there any sort of regulatory hurdles you'd have to think about?

A - Elon Musk {BIO 1954518 <GO>}

We -- as I said earlier, we're expecting to release the full self-driving software to anyone who orders the package by the end of this year. So a separate matter as to is it -- will it have regulatory approval. It won't have regulatory approval at that time. But the car will be able to take you from your home to your work, your friend's house, to the grocery store without you touching oil. So it's looking very good.

Q - Colin Langan {BIO 15908877 <GO>}

And it would mean like Level 4, Level 5 kind of traditional definition you're talking about?

A - Elon Musk {BIO 1954518 <GO>}

Well, there's this debate is like what's the -- what are the interventions per mile and I know this maybe safety interventions per mile. Like we're not saying that's -- and that's quite ready to have no one behind the wheel. It's just that you will almost

never have to touch the control, vehicle controllers. So like when I came to Giga Texas today from friend's house, I never touched any of the controls and we're right here.

And then there is a longer process of like that called the (inaudible) names of like how many names reliability do you need before you could really be comfortable saying that the car could drive with no one in it. And that's some subjectivity as to how many names you need. But I think we'll be pretty close to having enough names that you're going to have no one in the car by the end of this year. And certainly, without a question, that's whatever in my mind next year. I think we'll also have an update in next year to be able to show to regulators that the car is safer, much so than the average human.

Q - Colin Langan {BIO 15908877 <GO>}

Got it. And just as a follow-up, you mentioned in the prior questions about IRA. I mean it sounded like you thought you could get -- can you get all of it? I mean, because my interpretation is like the production credits, battery component credits for buyers seems very likely for you guys. Is the sourcing part of it possible? Because that seems like a pretty tough hurdle given how much has to be sourced from the US.

A - Andrew Baglino {BIO 21161872 <GO>}

Yeah. So we have a cross-functional team that's looking very closely. As you mentioned, the sourcing threshold increases by the year. So we're looking at all options and also getting some clarification from treasury. That's -- it's important to say that's only a fraction of the other credits. We do manufacture ourselves in the US. We manufacture the modules in the US. So that's a pretty (inaudible) there. So yes, we feel confident that we'll have a path as these incentives -- as the threshold sort of increases by the year.

A - Elon Musk {BIO 1954518 <GO>}

Yeah, we'll meet those thresholds.

Operator

Thank you. The next question comes from Colin Rusch from Oppenheimer. Colin, please go ahead and unmute yourself.

Q - Colin Rusch {BIO 15823117 <GO>}

Thanks so much guys. The operating leverage has been pretty impressive here. And I'm curious about areas where you could invest in an incremental way, whether it's on the R&D side or on the sales side to accelerate growth or cost reduction. Or should we be thinking about this level of spend on a go-forward basis and some significant operating leverage as you scale up from here?

A - Zachary Kirkhorn {BIO 20940148 <GO>}

I mean our operating leverage has improved quite a bit. It's the lowest this quarter, I think, ever, and by a decent amount. Our OpEx as a percentage of revenue. I mean, our forecast is that it will keep reducing. I mean I think the way to think about it is our total amount of operating expenses will slowly tick up as the company grows. It's very hard to keep it flat with the rapid growth of the company, but it's growing much slower.

So some amount of growth there, but the top line of the business is growing so quickly. So I think there continues to be enormous opportunity to improve the overhead efficiency of the business, and we're seeing it.

A - Elon Musk {BIO 1954518 <GO>}

Yeah.

Q - Colin Rusch {BIO 15823117 <GO>}

All right. Great guys. I'll take the rest of that offline.

A - Elon Musk {BIO 1954518 <GO>}

Look, we are in the -- at least for now, quite in a good position of we're investing in everything we can think of to possibly invest in and we're still generating cash. So I guess it gets a pretty good place to be.

Q - Colin Rusch {BIO 15823117 <GO>}

Yeah. I mean, how many R&D programs are we running in parallel right now?

A - Elon Musk {BIO 1954518 <GO>}

People don't even know old R&D per day. There are some of it, but a bunch of it, right?

A - Andrew Baglino {BIO 21161872 <GO>}

I also don't think cash is a good gauge of how much R&D you're doing.

A - Elon Musk {BIO 1954518 <GO>}

No. It isn't because it's not like -- it's not like engineers, they're not generic. So it's just like if you spend $5 billion or $10 billion, that will like -- that your actual R&D is useful product ship will be proportionate to that. It's just not true. Engineers on coming with some assembly line like cookies or something.

A - Andrew Baglino {BIO 21161872 <GO>}

Until we get Optimus.

A - Elon Musk {BIO 1954518 <GO>}

Yeah. Optimus will change things. What matters is where are the most brilliant people working. And Tesla remains the -- Tesla and SpaceX are two companies where the smartest engineers want to work.

A - Andrew Baglino {BIO 21161872 <GO>}

I mean, like we don't have to spend billions of dollars to invest in the future and invent the future. Engineers are also cost conscious and we don't. So just burn the money out the window when we're trying to do R&D. So I would stop looking at like R&D as a cash investment for (inaudible).

A - Elon Musk {BIO 1954518 <GO>}

I think one Nikola Tesla is frankly worth an infinite number of dollars above inch. Well, you could have like a -- almost separate number of credit shares and they would not be able to do worth one Nikola Tesla can do. You can't make it up in volume.

A - Martin Viecha {BIO 17153377 <GO>}

Okay. Thank you very much. Let's go to the next question from George at Canaccord. George, you can unmute.

Q - George Gianarikas {BIO 19376739 <GO>}

Hi, good afternoon and thanks for taking my question. I think you would -- at your Annual Shareholder's event where Elon mentioned that the prices of many of the materials used in your production have started to come off the boil. If that continues, does that give you an opportunity to adjust prices globally after several increases? Thanks.

A - Elon Musk {BIO 1954518 <GO>}

Well, we're looking at the prices of -- (inaudible) prices closely. I mean, obviously, anyone can just Google what the price of -- the future price of copper or steel is going to be. It's just like one Google search away. And everyone can see that the commodities on a go-forward basis are dropping a lot. But in electric vehicles, things like battery grade lithium are still crazy expensive. So we've got a mixture of things where prices are dropping and things where prices are increasing.

A - Andrew Baglino {BIO 21161872 <GO>}

I would say quarter-over-quarter, steel, aluminum has stopped anywhere between 17% to 20% at the same time on the battery side.

A - Zachary Kirkhorn {BIO 20940148 <GO>}

And the cost of shipping has come down tremendously. Like last year, the cost of a container on the spot market from Shanghai got as high as $20,000. And now it's $3,500, $3,600. It's that kind of reality. We're seeing deflation in a lot of commodities with a few exceptions, as we mentioned on batteries.

A - Elon Musk {BIO 1954518 <GO>}
There's more deflation than inflation.

A - Andrew Baglino {BIO 21161872 <GO>}
Definitely.

A - Elon Musk {BIO 1954518 <GO>}
And again, this is publicly available information anyone could just Google it. And I think Cathie Wood at Ark Invest is -- I don't want to make this point over and over again to the Fed and the Fed is not listening because they're looking at the rearview mirror instead of looking out the front windshield.

A - Zachary Kirkhorn {BIO 20940148 <GO>}
Yeah, just to add a little bit more context. So commodity increases were the highest in Q3 that we've seen over the last two years. And so when indexes change, it does take time before they fully reflect (Multiple Speakers). yeah.

A - Elon Musk {BIO 1954518 <GO>}
Yes, there's latency.

A - Zachary Kirkhorn {BIO 20940148 <GO>}
Yeah, there's latency.

A - Elon Musk {BIO 1954518 <GO>}
That's why I say that the Fed decisions make sense if you're looking through the rearview mirror, but not if you look out the windshield. And windshield we got front windshield.

A - Zachary Kirkhorn {BIO 20940148 <GO>}
Yeah. And so what -- at least of what we know so far, the peak on the commodity side in Q3, I say peak, hopefully, it stays the peak, hopefully, it starts to come down. There is a small amount of production that we're seeing going into our Q4 cost structure from steel and aluminum primarily, but it's less than 10% of the total increases we've seen so far. So we're optimistic here based upon what we're seeing on the indexes for some of our cost structure that this will start to come in over time. But I just want to set expectations that there's not some windfall of cost reduction in this space coming in Q4, maybe some as we go into next year.

A - Elon Musk {BIO 1954518 <GO>}
Yeah. We'll probably see some cost reduction in 2023. I'll be surprised if we did not.

Q - George Gianarikas {BIO 19376739 <GO>}

And just as a follow-up, this is for Elon. With your pending acquisition of Twitter and your stakes in SpaceX and Neuralink and Tesla, how much would the combined companies benefit from operating under a single super structure, if at all, like a Google Alphabet?

A - Elon Musk {BIO 1954518 <GO>}

It's not clear to me what the overlap is. It's not 0, but it's -- I think we're reaching. I'm not worried about it. I'm not an investor. I'm an engineer and a manufacturing person and a technologists. So I actually work and design and develop products. That's what I do. So it's not a -- we're not going to have a portfolio sort of investments over it. So I don't know. I don't see an obvious sort of work some get combined under an umbrella, at least right now.

So I am excited about the Twitter situation because obviously another part incredibly well. And I think it's massive that this sort of languished for a long time, but has an incredible potential. Although, obviously, myself and the other investors are obviously overpaying for Twitter right now. The long-term potential for Twitter, in my view is, in order of magnitude greater than its current value.

Operator

Thank you. Let's go to the next question from Pierre Ferragu from New Street Research. Pierre, go ahead please and unmute.

Q - Pierre Ferragu {BIO 15753665 <GO>}

Can you hear me, guys?

A - Martin Viecha {BIO 17153377 <GO>}

Yes, we can hear you now.

Q - Pierre Ferragu {BIO 15753665 <GO>}

Great. I'd love to have another update on 4680, Drew. So last time we talked about it, there were -- was question -- it was a question about like scaling up with manufacturing and there were still a few things to get right. Is it fair to say that now you are at scale, and it's just a question of logistics to get bigger? So that's question number one.

And then question number two, on the kind of like innovation and cost reduction and efficiency improvements kind of path that you described at the Battery Day, where are we today? And how much time is it going to take to deliver all the potential you outlined then?

A - Andrew Baglino {BIO 21161872 <GO>}

Well, I'll take the second question first. At Battery Day, we showed a time line out to 2026 for all of the ideas we had proposed and had shared with everybody then. And...

A - Elon Musk {BIO 1954518 <GO>}

Yeah, I'd be surprised. I think we'll do better than that.

A - Andrew Baglino {BIO 21161872 <GO>}

Yeah. I mean, but just that's the rough -- just give you all -- it's on that order. It's not like a month. It's not six months. It's years. And we are executing on all of those different ideas pretty aggressively in parallel with the OpEx that some people think isn't enough, but we're getting it done.

A - Elon Musk {BIO 1954518 <GO>}

I'm not turning down deals.

A - Andrew Baglino {BIO 21161872 <GO>}

Yeah, yeah, or great talent, like we find out (Multiple Speakers), we bring them into the company. And people shouldn't believe we are turning people away.

A - Elon Musk {BIO 1954518 <GO>}

Yeah. I mean, it's a hot problem that we're solving it. And I think we still feel confident that 4680 will be the most competitive battery cell in the world.

A - Andrew Baglino {BIO 21161872 <GO>}

And it's the whole system around it, right? It's not necessarily a specific form factor. It's the attention to detail on how to bring costs out of the manufacturing process or remove processing steps.

A - Elon Musk {BIO 1954518 <GO>}

And all the way down from the mine to the cell.

A - Andrew Baglino {BIO 21161872 <GO>}

Yeah, exactly.

A - Elon Musk {BIO 1954518 <GO>}

Many steps along the way.

A - Andrew Baglino {BIO 21161872 <GO>}

Yeah. And for those who watched the YouTube videos, like our on-site cathode facilities coming together, I'm really excited about that, which is a part of the plan that we discussed on Battery Day.

A - Elon Musk {BIO 1954518 <GO>}

Yeah. We're possibly building lithium refinery.

A - Andrew Baglino {BIO 21161872 <GO>}

In Corpus Christi. So we're making -- putting our money where our mouths are and all the various efforts that we discussed on Battery Day. On the technical challenges and the ramp question, which is your first question of 4680, look, no ramp is ever easy even at the end when you're 80% to the end, like it's still very challenging to get to the end. And that sort of leaning out of yields, the final cycle time to achieve target. You mentioned logistics, it's not something that we're specifically focused on, I guess, but eventually could be a problem as we're talking about hundreds of gigawatt hours at different sites across the United States.

But I would never sit here and say we have no challenges remaining. But we've made a lot of progress reducing technical risk in many areas. Cycle times have dramatically improved. Yield has dramatically improved. And just walking the line here in Texas, like Martin was walking it yesterday, made some comments to me. You really see the acceleration around you. And we've made a ton of simplifications moving from the Fremont factory to Texas, and it's coming to play in speed of ramp here. And of course, that's on one line of many here in Texas so it's not like factory to factory. It's a multiplication of both simplicity and scale. So yeah, we're excited about where it's headed.

A - Elon Musk {BIO 1954518 <GO>}

Yeah. And I think, once we are fully integrated, I think we still do see a path to hold roughly $70 kilowatt hour cell -- $70 per kilowatt or so before any incentive.

A - Zachary Kirkhorn {BIO 20940148 <GO>}

Before incentive.

A - Elon Musk {BIO 1954518 <GO>}

Before incentive.

A - Martin Viecha {BIO 17153377 <GO>}

Thank you. And the next question comes from Toni Sacconaghi from Bernstein. Toni, go ahead and unmute yourself, please.

Q - Toni Sacconaghi {BIO 3056875 <GO>}

Yes. Thank you. I just wanted to follow-up on the 4680 cells and where we are seeing them deployed today. So are those in the Semis that are being delivered on December 1st? Are we seeing them in Model Ys that are being produced out of Austin? And is -- do you anticipate 4680 being a gating factor for Cybertruck ramp later this year? And how do you balance the need for 4680 across Semi, Cybertruck and potentially Model Y in 2023? And I have a follow-up, please.

A - Elon Musk {BIO 1954518 <GO>}

Wow. Okay. The Semi doesn't use 4680s. Yes. We are making Model Ys. Some of the Model Ys coming out of Giga Texas are 4680. And I think, Drew, the car you drive around is 4680 Model Y?

A - Andrew Baglino {BIO 21161872 <GO>}

Yeah. 10,000 miles.

A - Elon Musk {BIO 1954518 <GO>}

10,000 miles. Yeah, pretty good.

A - Andrew Baglino {BIO 21161872 <GO>}

No problems yet. Yes.

A - Elon Musk {BIO 1954518 <GO>}

Structural pack.

A - Andrew Baglino {BIO 21161872 <GO>}

Structural pack.

A - Elon Musk {BIO 1954518 <GO>}

Yeah. So -- and yeah, I mean, and our output of 4680 is growing exponentially. So -- but it's worth bearing in mind like there are entire highly competitive companies that are very smart that all they do is make battery cells. This is simply one segment of Tesla. So it's not a total coupon.

A - Andrew Baglino {BIO 21161872 <GO>}

No, there is -- there aren't. There are challenges still ahead that we have not yet surpassed. No doubt.

A - Elon Musk {BIO 1954518 <GO>}

We don't anticipate this being any limiting factor for Cybertruck or anything else.

A - Martin Viecha {BIO 17153377 <GO>}

Okay. And the last question comes from William Stein from Truist. Go ahead and unmute yourself, please.

Q - William Stein {BIO 15106707 <GO>}

Great. Thanks for taking my question. I guess I'll go at one that I asked last time, Elon, which is your expectation for the likelihood of commercial success in each of the three major AI endeavors. FSD sort of as imagined without a driver, the training computer and of course, Optimus?

A - Elon Musk {BIO 1954518 <GO>}

We'll achieve full self-driving full autonomy -- already that occurring is 100%. And I think we'll -- we're almost there. And then, of course, we've got to prove it to regulators and get the regulatory approvals, which is outside of our control. But anyone who's driving full self-driving cars, as the full self-driving beta in their car can see the rate of improvement. You can just experience for yourself that we are, in fact, getting there. In fact, we almost are there. And so we're probably achieving that 100%.

The Optimus, probably of that being a successful product, I think, also extremely high because given enough time, 100%. Dojo, just maybe more of a question like around Dojo. Like can we be competitive with NVIDIA GPUs even as NVIDIA continues to rapidly evolve their GPUs? So the jury is out on Dojo. There's a team things they can outperform NVIDIA for on that training. The jury's out, we will probably -- I don't know, next year, if that's true or not. But we think we're probably -- we think it's -- this is -- the architecture of Dojo is the right architecture to win. It depends on how well we execute within that architecture.

A - Martin Viecha {BIO 17153377 <GO>}

Thank you very much. I think, unfortunately, it's all the time that we have today. So thank you so much for your great questions and look forward to talking to you in about three months from now. Thank you, and have a good day.

A - Elon Musk {BIO 1954518 <GO>}

Thanks, everyone.