Q1 2021 Tesla Inc Earnings Call Transcript

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Operator

Good day, ladies and gentlemen, and thank you for standing by, and welcome to the Tesla First Quarter 2021 Results and Q&A Webcast. (Operator Instructions) Please be advised that today's conference is being recorded. (Operator Instructions)

I will now hand the conference over to your speaker today, Martin Viecha, Senior Director of Investor Relations.

Martin Viecha - *Tesla, Inc. - Senior Director for IR*

Thank you, Carmen, and good afternoon, everyone, and welcome to Tesla's First Quarter 2021 Q&A Webcast. I'm joined today by Elon Musk, Zachary Kirkhorn and a number of other executives. Our Q1 results were announced at about 1:00 p.m. Pacific Time in the update deck we published at the same link as this webcast.

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

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

Elon R. Musk - *Tesla, Inc. - Technoking of Tesla*

Great. Thank you. So Q1 2021 was a record quarter on many levels. Tesla achieved record production, deliveries and surpassed $1 billion in non-GAAP net income for the first time. And we've seen a real shift in customer perception of electric vehicles, and our demand is the best we've ever seen. So this is -- [we're talking about] we're used to seeing a reduction in demand in the first quarter, and we saw an increase in demand that exceeded the normal seasonal reduction in demand in in Q1.

So Model 3 became the best-selling midsized premier sedan in the world, in fact, I should say the best-selling luxury sedan of any kind in the world. The BMW 3 Series was for the longest time the best-selling premium sedan, has been exceeded by the Tesla Model 3. And this is only 3.5 years into production and was just 2 factories. For Model 3 to be outselling its combustion engine competitors, I think, is quite remarkable.

In the past couple of quarters, we delivered roughly 0.25 million Model 3s, so -- which translates to annualized rate of 0.5 million per year.

When it comes to Model Y, we think Model Y will be the best-selling car or vehicle of any kind in the world and probably next year. So I'm not 100% certain next year, but I think it's quite likely. I'd say more likely than not, that in 2022, Model Y is the best-selling car or truck of any kind in the

world.

Then with regard to Full Self-Driving. Full Self-Driving beta continues to make great progress. It is definitely one of the -- I think one of the hardest technical problems that exists, that's maybe ever existed. And really, in order to solve it, we basically need to solve a pretty significant part of artificial intelligence, specifically real-world artificial intelligence. And that sort of AI, the neural net needs to be compressed into a fairly small computer, a very efficient computer that was designed, but nonetheless, a small computer that's using on the order of 70 or 80 watts. So this is a much harder problem than if you were you, say, 10,000 computers in a server room or something like that.

This has got to fit into a [smaller sprain]. And this -- I think with the elimination of radar, we're finally getting rid of one of the last crutches. Radar was really -- it was making up for some of the shortfalls of vision, but this is not good. You actually just need vision to work. And when [beam] works, it works better than the best human because it's like having 8 cameras, it's like having eyes in the back of your head, beside your head and has 3 eyes of different focal distances looking forward. This is -- and processing it at a speed that is superhuman. There's no question in my mind that with a pure vision solution, we can make a car that is dramatically safer than the average [person].

So -- but it is a hard problem because we are actually solving something quite fundamental about artificial intelligence, where we basically have to solve real-world vision AI. And we are. So -- and key to solving this is also having some massive data set. So just having well over 1 million cars on the road that are collecting data from very sort of corner case rare situations -- sort of like so many weird things in the world like a truck carrying a truck or a car with -- one example is like a car as an actual example, a car with the kayak on the roof where the kayak has a little weight dangling from the front of the kayak in front of the car and -- but yet the car must ignore this and just look at the road.

So it's really quite tricky, but I am highly confident that we will get this done. So -- yes. This quarter, and I think we'll continue to see that a little bit in Q2 and Q3. So Q1 was -- had some of the most difficult supply chain challenges that we've ever experienced in the life of Tesla and same difficulties with supply chain, with parts -- over the whole range of parts. Obviously, people have heard about the chip shortage. This is a huge problem. But then in addition to that, for example, we had quite a difficulty scaling, driving our production in China because we're unable to get critical engineers there because of COVID quarantine restrictions. So -- which meant that Tesla worldwide was dependent on drive units made at our factory in Nevada, Giga Nevada. So that was a very challenging situation.

I think we're mostly out of that particular problem. That's just -- those was just 2 of many challenges. So the team has really done an incredible job of dealing with really severe supply chain shortages.

So with respect to the Model S and X, there were more challenges than expected in developing the Model S or what we call the Palladium program, which is the new version of Model S and X, which has revised interior and new battery pack and new drive units and new internal electronics and has, for example, a PlayStation 5 level infotainment system. There's just a lot of issues encountered, ensuring that the new factory was, [as also we're saying] was quite hard because we were working more energy in a smaller pace. So it took quite a bit of of development to ensure that the battery of the new S/X is safe. And we're trying to get all the -- in the cars slowly for the past few months. But we're just stacking them up in the yard and just making refinements to the cars that we built. But we do expect to ramp Model S production and start delivering them probably next month. And then to be in sort of fairly high volume production for the X in Q3 and start delivering Model X in Q3 as well.

So I think as we ramp up, I think probably the demand for the new S/X will be quite high. So it's really just going to be a question of ramping supply chain and internal production processes. So probably, like, we're going to aim to produce over 2,000 S/X per week. Perhaps if we get lucky, upwards of 2,400 or 2,500. This again is contingent on global supply chain issues, which is just a lot of factors outside of our control here. But I do think [these will get solved], so it's just a matter of time, and then we'll be doing well over 2,000 S/X per week. It's a great car. It actually costs us less to produce, a little bit less to produce, but it is a superior product.

So in conclusion is there's a lot to be excited about in 2021 and '22. We're building factories as quickly as we can. Both Texas and Berlin are progressing well, and we expect to have initial limited production from those factories this year and volume production from Texas and Berlin next year. At this time, we are continuing to ramp production of Model Y in Fremont and Shanghai. In the background, we're continuing work -- development work on the Semi, Cybertruck, the Roadster and other products. Thanks to everyone at Tesla who made this year a huge success. Now on to questions.

Martin Viecha - *Tesla, Inc. - Senior Director for IR*

Thank you very much. We have some remarks from Zachary Kirkhorn as well.

Elon R. Musk - *Tesla, Inc. - Technoking of Tesla*

Okay.

Zachary J. Kirkhorn - *Tesla, Inc. - Master of Coin*

Yes. Thanks, Martin. Thanks, Elon. So congratulations to the Tesla team on breaking multiple records in the first quarter of '21, as Elon had mentioned, which is typically the most difficult of the year for many reasons.

To summarize the quarter, I think it's best understood by 3 key items. First, we successfully launched and began the ramp of Model Y in Shanghai, achieving positive gross margin in the first quarter of production and receiving a great reception from the market. Second, as Elon mentioned, although we began the production process for the Model S during the quarter, we had not yet begun customer deliveries. The reduction in Model S and X deliveries from Q4 to Q1 were a meaningful headwind to free cash flows and profit generation.

For example, we incurred an estimated $200 million of direct P&L impact relating to this program in Q1, the majority of which is reflected in COGS and that's before even considering the impact of lost revenue and profits as a result of the transition. And as he mentioned -- as Elon mentioned, we expect the first deliveries to begin shortly.

Third, as we continue to work through the instability of the global supply chain, particularly around semiconductors and port capacities, while the Tesla team in partnership with our suppliers did tremendous work keeping our factories running, we did experience high expedite costs in the quarter, and they were also higher than they were in Q4, with some minor interruptions to production over the course of the quarter. We believe that this landscape is improving, but it does remain difficult, and it's an evolving situation.

If we double-click within net income. Auto gross margin, excluding credits, improved sequentially and year-over-year. This is in spite of the cost mentions for S and X and expedites and a reduction in global ASPs as our cost structure as a company is reducing at an even faster pace. So as we look out over the course of the year, we feel optimistic about our gross margin strength, particularly as

some of these headwinds we're experiencing start to be resolved.

On services and other margins, these have recovered and are trending towards profitability, aided by strength in the used car business, operational improvements in service and additional service revenue opportunities that help absorb fixed overhead.

On energy gross margins, these remained negative for second quarter. This is driven by solar-related ramp costs and winter seasonality in the lease PPA business. We continue to manage through a multi-quarter backlog on Powerwall. We're working as fast as we can to increase production. And this will aid in profitability of this business as those volumes increase.

On operating expenses, these increased for Q1, which is driven by our investments in technology and growth. In particular, for R&D, this includes the structural battery pack and 4680 cells, investments in the new S and X and our neural net and silicon investments.

On the SG&A side, we're setting up infrastructure and support for both China and EMEA in anticipation of volume to come there. And as I said before, our plans show that we remain on track for sustained industry-leading operating margins.

Double-clicking on cash flows. We continue to generate positive free cash flows, and this was despite the significant working capital headwinds from S and X. Additionally, we are making progress reducing various forms of debt. We also invested $1.5 billion in bitcoin during the quarter, then trimmed our position by 10%, which contributed to a small gain in our Q1 financials.

Taking a step back, we've generated $8 billion in operating cash flows and $4 billion in free cash flows over the past 4 quarters. As we look forward, our plans remain unchanged for long-term growth of 50% annually, and we believe we're on track to exceed that this year as we guided to last quarter. Global demand remains meaningfully higher than production levels. And so we're driving as fast as we can to increase our production rates. As we think about Q2 and Q3, these quarters should largely be driven by execution on S and X, as we've discussed, continued ramp of Model Y in Shanghai and the associated cost reductions of these programs. And we expect profitability and cash generation to evolve over the course of the year in line with those improvements.

And then as we get towards the end of the year, our story will pivot towards the launch and ramp of our newest factories in Austin and Berlin. So there's certainly no shortage of exciting things for us to work on and look forward to. Thank you, and we'll open it up for questions.

Questions and Answers:

Martin Viecha - *Tesla, Inc. - Senior Director for IR*

Thank you very much. And we'll first take retail questions from, say, website. The first question is, how is Dojo coming along? Could Dojo unlock an AWS like business line for Tesla over the next few years?

Zachary J. Kirkhorn - *Tesla, Inc. - Master of Coin*

Yes. I'll jump in here. So with respect to Dojo...

Elon R. Musk - *Tesla, Inc. - Technoking of Tesla*

Sorry, Zach. My apologies. I was on mute.

Zachary J. Kirkhorn - *Tesla, Inc. - Master of Coin*

Go ahead, Elon.

Elon R. Musk - *Tesla, Inc. - Technoking of Tesla*

So yes, I was just basically saying that the -- although like right now, people think of Tesla as -- a lot will think of Tesla as a car company or as an energy company. I think long term, people will think of Tesla as much as an AI robotics company as we are a car company or an energy company. I think we are developing one of the strongest hardware and software AI teams in the world. Certainly, we appear to be able to use things with full self-driving that others cannot. So if you look at the evolution of what technologies we developed, we developed them in order to solve the problem of self-driving. So we couldn't find a powerful enough neural net [in terms of a] computer. So we designed and built our own.

The software out there was really quite primitive for this task. And so we built the team from scratch and have been developing what we think is probably the most advanced real-world AI in the world. And then it sort makes sense that this is kind of what needs to happen because the road system is designed for a neural net computer, our brain. Our brain is neural net computer. And it's -- the entire road system is designed for vision with a neural net computer, which is because it's designed for eyes in the brain. And so if you have a system which has very good eyes, you can see in all directions at once, you can see 3 focal points ahead or forward, but it never gets tired. It's never sort of texting. It has redundancy and its reaction time is super human. Then it seems pretty obvious that such a system would achieve an extremely high level of safety, far in excess of the average person.

So that's what we're doing. Then Dojo is kind of the training part of that. So because we're -- we have over 1 million cars, and perhaps next year, we'll have 2 million cars in active use, providing vast amounts of video training data that then needs to be digested by a very powerful training system. And currently, we use Tesla training software. So we developed a lot of training software, a lot of labeling software to do, to able to do surround video labeling, which is quite tricky. This means all 8 cameras simultaneously at 36 range a second per camera labeling video over time. There wasn't any tool that existed for this, so we developed our own labeling tool.

Then taking it a step further, obviously, the Holy Grail is auto labeling. So now we're getting quite good at auto labeling, where we do -- where -- that the trainers train the training system and then the system auto labels the data and then the human laborers just need to look at the labeling to confirm that it is correct and perhaps make edits. And then every time an edit is made, that further trains the system. So it's kind of like a flywheel that's just sort of spinning up. And really, the only way to do this is with vast amounts of video data.

So then we need to train this efficiently. So Dojo is really a -- it is a supercomputer optimized for neural net training. We think Dojo will be, probably in order of magnitude, more efficient on, say -- not sure what the exact right metric is, but say, per frame of video, we think it will be an order of magnitude more cost efficient in hardware and in energy usage for a frame of video compared to a GPU-based solution or compared to the next best solution that we're aware of.

So then possibly that could be used by others. It does seem as though over time -- I mean just an observation, I think basically is the fact that neural net based computing or AI-based computing is and more and more of the compute stack. We -- conventional computing -- well, perhaps heuristics-based computing is still going to be important, still going to be very important, but it will become -- but neural net will become a bigger and bigger portion of compute. So a long story, but I think, yes, probably others will want to use it too, and we will make it available.

Martin Viecha - *Tesla, Inc. - Senior Director for IR*

Let's go to the second question from retail investors. The recent price changes on solar roof have been discouraging for customers and investors. Could just like share more about solar roof challenges? And if the outlook has changed at all, i.e., 1,000 roofs per week.

Elon R. Musk - *Tesla, Inc. - Technoking of Tesla*

Yes. First of all, I should say that the demand for the solar roof remains strong. So despite raising the price, the demand is still significantly in excess of our ability to meet the demand to install the solar roofs. So production is going fine, but we are [curbed] at the installation point. We did find that we basically made some significant mistakes in assessing the difficulty of certain roofs, but the complexity of roofs varies dramatically. Some roofs are to be literally 2 or 3x easier than other roofs. So you just can't have a one-size-fits-all situation. If a roof has a lot of protuberances or if the roof sort of -- the core structure of the roof is rotted out or is it not strong enough to hold the solar roof, then the cost can be double, sometimes 3x what we -- what our initial quotes were. So in those cases, what we obviously opt to do is to refund customers their deposit and -- but what we cannot do is go and just lose a massive amount of money. We just got to provide a refund of the early deposit.

But that's what is, I think, most important about the solar roof situation, which I tweeted about this past week, is that we're shifting the whole sort of solar situation -- the solar power -- well, basically, solar power situation to there's only 1 product basically -- or there's only 1 configuration. Every house -- we will not sell a house solar without a Powerwall. That solar could either be solar retrofit with conventional panels put on the roof or it can be the Tesla Solarglass Roof. But in all cases, it will have the power to -- technically, this is -- it's actually Powerwall 2 plus, if you will. The plus refers to a higher peak power capability.

So basically, all Powerwalls made since roughly November of last year have a lot more peak power capability than the specification on the website. They have about twice the power capability roughly. It depends on how you count power, but about twice the peak power and about arguably twice the steady-state power of the specification of the website. The energy is the same, but the power is roughly double. And all the installations -- so all installations will have a Powerwall. And the difficulty installation will dramatically -- or the difficulty of the installation will be much less. It will be much easier because the power from the solar roof -- Solarglass Roof or the solar panels will only ever go directly into the Powerwall. And the Powerwall will only ever go between the utility means -- between the utility and the main power panel of the house, which means you never need to touch the main circuit breakers of the house. You never need to touch the house circuit breakers. Effectively, almost every house, therefore, looks the same electrically instead of being a unique work of art and requiring exceptional ability to rewire the main panel.

So this is extremely important for scalability is. It's the only way to do it, really. And this also means that every solar Powerwall installation that the house, or whatever the case may be, will be its own utility. And so even if all lights go out in the neighborhood, you will still have power. So that gives people energy security.

And we can also, in working with the utilities, use the Powerwalls to stabilize the overall grid. So let's say that there's a -- like there was in Texas, there was a peak power demand, and the power demand, because the grid lacked the ability to buffer the power, they had to shut down power. There's no power storage. No good point on power storage. However, with a whole bunch of Powerwalls and houses, we can actually buffer the power. And so if the grid needs more power, we can actually then, with the consent, obviously, of the homeowner and in partnership with the utility, we can then actually release power onto the grid to take care of peak power demand.

So effectively, the Powerwalls can operate as a giant distributed utility. This is profound. I'm not sure how many of you will actually understand this but this is extremely profound and necessary because we are headed towards a world where, as we were just talking about earlier, where people are moving towards electric vehicles. This will mean that the power needs in -- at homes and businesses will increase significantly. We will -- there will need to be a bunch more electricity coming somewhere. In fact, if you go to full renewable electricity, we need about 3x as much electricity as we currently have. So these are rough numbers, but roughly you need twice -- roughly need twice much electricity if all transport goes electric, and they need 3x much electricity if all heating goes electric. So basically, this is a prosperous future, I think, both for Tesla and for the utilities.

Because -- and in fact, I think this will be very -- if this is not done, the utilities will fail to serve their customers. They won't be able to do it. They won't be able to react fast enough. And we're going to see more and more of what we see, say, in California and Texas of people seeing brownouts and blackouts and the utilities not being able to respond because there's a massive change going on with the transition to electric transport. And we're seeing more extreme weather events. This is a recipe for disaster. So it is very important to have solar and batteries at the local level, at the house.

In addition, it is important to have large battery storage at the utility level, so that solar and wind, which are the main forms of renewable electricity, can be -- that electricity can be stored because sometimes the wind doesn't blow, sometimes it blows wide. Sometimes it blows too much and sometimes it didn't blow enough. But if you have a battery, you can store the energy and provide the energy to the grid as needed. The same goes for solar because, obviously, the sun does not shine at night and sometimes it is very cloudy. And so by having battery storage paired with solar and wind, this is the long-term solution to a sustainable energy future.

And as I said, it needs to occur both at the local level and at the utility level. If it doesn't occur at the local level, what will actually be required is a massive increase in power lines in power plants. So they have to put long distance and local power lines all over the place. They'll have to increase the size of the substations, is a nightmare. This must occur. There must be solar plus battery. That's the only way. So yes.

Martin Viecha - *Tesla, Inc. - Senior Director for IR*

Thank you very much. And the next retail question is, master of coin, can you tell us anything about Tesla's future plans in digital currency space or when any such major developments might be revealed?

Zachary J. Kirkhorn - *Tesla, Inc. - Master of Coin*

Sure. Thanks, Martin. So as I noted in our opening remarks and we've announced previously, so Tesla did invest $1.5 billion into bitcoin in Q1, and then we subsequently sold a 10% stake in that. We also allow customers to make vehicle deposits and final vehicle purchases using bitcoin. And so where our Bitcoin story began, maybe just to share a little bit of context here. Elon and I were looking for a place to store cash that wasn't being immediately used, trying to get some level of return on this, but also preserve liquidity. Particularly as we look forward to the launch of Austin and Berlin and uncertainty that's happening with semiconductors and port capacity, being able to access our cash very quickly is super important to us right now. And there aren't many traditional opportunities to do this or at least that we found and in talking to others that we could get good feedback on, particularly with yields being so low and without taking on additional risk or sacrificing liquidity. And Bitcoin seemed at the time and so far has proven to be a good decision. A good place to place some of our cash that's not immediately being used for daily operations or maybe not needed till the end of the year and be able to get some return on that.

And I think one of the key points that I want to make about our experiences in the digital currency space is that there's a lot of reasons to be optimistic here. We're certainly watching it very closely at Tesla, watching how the market develops, listening to what our customers are saying. But thinking about it from a corporate treasury perspective, we've been quite pleased with how much liquidity there is in the bitcoin market. So our ability to build our first position happened quickly. When we did the sale later in March, we also were able to execute on that very quickly.

And so as we think about kind of global liquidity for the business in risk management, being able to get cash in and out of the market is something that I think is exceptionally important for us. So we do believe long term in the value of bitcoin. So it is our intent to hold what we have long term and continue to accumulate bitcoin from transactions from our customers as they purchase vehicles.

Specifically with respect to things we may do, there are things that we're constantly discussing. We're not planning to make any announcements here, and we're watching this space closely. So when we're ready to make an announcement on this front, if there's one to come, we'll certainly let you all know.

Martin Viecha - *Tesla, Inc. - Senior Director for IR*

Thank you. And the fourth question from retail investors is, does Tesla have any proactive plans to tackle mainstream media's imminent, massive and deceptive click-based headline campaigns on safety of autopilot or FSD for a specialty PR job of some sort?

Lars Moravy - *Tesla, Inc. - VP of Vehicle Engineering*

Well, I can -- I'll take this one, guys. From the safety side, I continue to say -- Elon, drive the point and I'll -- go ahead, Elon.

Elon R. Musk - *Tesla, Inc. - Technoking of Tesla*

I think -- no, please go ahead. I think it's just worth going through the facts of the -- what -- I mean, specifically, there were -- there was an article regarding a tragedy where there was a high-speed in Tesla. But -- and there was really just extremely deceptive media practices where it was claimed to be Autopilot where this is completely false. And those journalists should be ashamed of themselves. Please go ahead, Lars.

Lars Moravy - *Tesla, Inc. - VP of Vehicle Engineering*

Yes. Thanks, Elon. So I was just saying, we're committed to safety in all our designs, and that's number 1 in what we do here.

Regarding the crash in Houston, specifically, we worked directly with the local authorities, NTSB and NHTSA, wherever applicable and whenever they reach out to us for help directly on the engineering level and whatever else we can support.

In that vein, we did a study with them over the past week to understand what happened in that particular crash. And what we've learned from that effort was that Autosteer did not and could not engage on the road condition that -- as it was designed. Our adaptive cruise control only engage when a driver was buckled in about 5 miles per hour. And it only accelerated to 30 miles per hour with the distance before the car crashed. As well adaptive cruise control disengage the cars fully to complete to a stop when the driver's seatbelt was unbuckled. Through further investigation of the vehicle and accident remains, we inspected the car with NTSB and NHTSA and the local police and were able to find that the steering wheel was indeed deformed so there must -- leading to a

likelihood that someone was in the driver's seat at the time of the crash and all seatbelts post crash were found to be unbuckled. We're unable to recover the data from the SD card at the time of impact, but the local authorities are working on doing that, and we await their report.

As I said, we continue to hold safety in a high regard and look to improve our products in the future through this kind of data and other information from the field.

Martin Viecha - *Tesla, Inc. - Senior Director for IR*

Okay. Thank you very much. Let's go to the next question from institutional investors. The first question is, proponents of alternative grid storage technologies claim that lithium-ion is unsuited for long-term storage at scale due to vampire drain. Could 4680 cells address this limitation? Is the limitation even relevant for charging the energy equation?

Andrew D. Baglino - *Tesla, Inc. - SVP of Powertrain & Energy Engineering*

Yes. Just let me jump in on the vampire drain. That's definitely not the issue. Good lithium ion cell self discharges less than 0.001% of its energy per day. So it's -- this vampire drain is maybe not that...

Elon R. Musk - *Tesla, Inc. - Technoking of Tesla*

I just love they call it vampires.

Andrew D. Baglino - *Tesla, Inc. - SVP of Powertrain & Energy Engineering*

Yes. Yes, I think the challenge with seasonal storage is your value proposition drops from hundreds of useful full cycles per year to less than maybe 10 or maybe even less than 5 cycles per year. So it's just a different type of technology altogether that would make sense, given that it's more than an order of magnitude, different use case.

Elon R. Musk - *Tesla, Inc. - Technoking of Tesla*

Yes. We've got a long way to go before we're dealing with seasonal technology issues. But certainly a way to deal with seasonal technology would be to have wind and solar erring on the side of more [sublay] latitude and -- but then across a variety of longitude. So essentially, like let's say, in the U.S., for example, if there was a -- I'm not sure if you'll understand this, you can actually power the entire United States with just sort of 100 -- roughly a 100-mile -- by a 100-mile grid of solar. Some people don't quite understand like, well, how much solar is needed to power the United States. Almost nothing of the (inaudible) of almost any country in the world.

The solar incident is a gigawatt per square kilometer. This is insane. In fact, you took the clear area, just the area or saying for nuclear power plants, the area that is considered not usable because of a nuclear power plant is there, in most cases, if you just put solar there, it would generate more power than the nuclear power plant because they typically have pretty wide clear areas. So it really -- so if you have, say, 25% efficient solar panels and then those are 80% efficient in how they laid out, you're going to do about 200 megawatts per square kilometer. Therefore, [5 straight] kilometers is a gigawatt, which might be a typical sort of power plant. It's really not much area at all. And a lot of places can have wind and solar in place.

So anyway, it's entirely possible to power all of earth with a small percentage of earth's area. And then to transfer that power through high-voltage DC lines with no new technology. No -- you don't need like room temperature superconductors. This another room temperature superconductors. This is a total -- also another myth. Room temperature superconductors, almost irrelevant, in my opinion,

almost irrelevant. Low-cost, long-distance power lines using copper or aluminum is very important. So heating is [ice where are]. So that's current square type of resistance. So as you increase voltage, you can drop the current dramatically and drop the heating dramatically to the point where it is of minor relevance, like maybe you lose 5% to 7% with a high-voltage DC power line, something like that.

So I want to be clear. (inaudible) no new materials are necessary. We just need to scale this thing up. We -- the technologies exist today to solve renewable energy. And some people will say, well, why don't we do it? That's because the energy basis of the earth is gigantic, super mega insanely gigantic. So you can't just go and do 1 zillion terawatts overnight. You've got to build the production capacity for the cells, for the battery cells, for the solar cells. You've got to put that into vehicles. You've got to put that into (inaudible) storage packs. You've got to put that into solar panels and Solarglass Roofs, and you've got to deploy all this thing -- all this stuff.

But it is certainly the case that we can accelerate this. And we should try to accelerate it. And the right thing to do, I think, from an economic standpoint, and I think an economist to agree is to have a common tax, just as we have a tax on cigarettes and alcohol, which we think are more likely to be bad than good, and we tend to tax fruit and vegetables less. It was the same should be true. We should tax energy that we think is probably bad and support energy we think is probably good, just like cigarettes and alcohol versus fruits and vegetables. This is common sense.

And -- but I guess on the plus side, I'm not suggesting anyone be complacent. But sustainable energy, renewable energy will be sold, it is being sold, but it matters how fast we sold it. And if we sold it faster, that's better for the world. There's no question in my mind whatsoever that the energy storage problem can be solved with lithium-ion batteries, zero. I want to be clear, zero.

I think the bias will tend to be towards iron-based lithium-ion cells. When we say lithium-ion, you will think lithium must be a big constituent of the cells. It's more like 1% to 2% of the cell is lithium. But the main part of the cell is the cathode, the main mass and cost in the cells is the cathode. For high-energy cells, like for example, what we use in most -- most Teslas have nickel-based lithium-ion cells, which have higher energy density, longer range than iron-based cells. However, stationary storage, the energy density is not as important because it's just staying on the ground. And so I think the vast majority of stationary storage will be iron-based lithium-ion cells with an iron phosphate cathode technically. But I think the phosphate part is unnecessary, so is the iron ore nickel. I'm destroying the terminology. Just think of it as iron and nickel. And there's an insane amount of iron in the world, more iron than we could possible use. And there's also more lithium than we could possibly use. Basically, there is no shortage of anything whatsoever in iron plus base lithium-ion cells.

Martin Viecha - *Tesla, Inc. - Senior Director for IR*

Thank you very much. Let's go to the next question from institutional investors, which is you suggested that between a 5x to 10x improvement is achievable in the automotive production versus the first Model 3 line on the first principles physics analysis. Where does Berlin sit relative to that limit?

Elon R. Musk - *Tesla, Inc. - Technoking of Tesla*

I think we're still quite far away from it. I mean the thing to bear in mind with production is -- for those who've never done production, they just don't understand how insanely hard production is. I want to really be very, very emphatic here. Prototypes are trivial, they're child's play. Production is hard, is very hard. Now you say production at large scale with higher liability and low cost, insanely difficult. But Tesla achieved on the automotive side was not to create an electric car. The truly profound thing on the car side is that Tesla was the first American car company to achieve

volume production of a car in 100 years and not go bankrupt.

So this is -- this -- basically, myself and many others at Tesla had to basically have several aneurysms to get this done. It was so hard to have no idea. So anyway -- and the thing about making a large complex manufacturing object is, let's say you have first-order approximation, 10,000 unique items. And even one of those items is slow, that says you wait, just one. Doesn't matter how -- so trivial. We've had production stop because of carpet in the trunk. We've had production stop because of a USB cable. At one point, for Model S, the -- we literally raided every electronics store in the Bay Area. For a few days there, nobody could buy a USB cable in the Bay Area because we went and bought them all to put them in the car, literally.

And there's like hundreds of stories like that. So anyway, that -- solving that -- those constraints and a logistics problem that makes World War II look trivial. I'm not kidding. Like the scale is insane. We're talking millions of cars, massive global supply chain, 50 countries, dozens of regulatory regimes. It's insane. So yes.

Martin Viecha - *Tesla, Inc. - Senior Director for IR*

Thank you. And last question from an institutional investor is master plan part 2 talks about an urban transport vehicle that is smaller than traditional bus with greater aerial density achieved by removing the central aisle. Do you have any updates to share on this goal?

Elon R. Musk - *Tesla, Inc. - Technoking of Tesla*

Not at this time.

Martin Viecha - *Tesla, Inc. - Senior Director for IR*

Okay. Thank you very much. So let's move to analyst Q&A.

Operator

First question is from Pierre Ferragu with New Street Research.

Pierre C. Ferragu - *New Street Research LLP - Global Team Head of Technology Infrastructure*

I'd love to get actually based on what you presented on the Battery Day. In the last 6, 7 months, I want -- I was wondering how much progress you've made on that front, first, in terms of process development. So how are things coming together on your pilot line? Are you getting to the kind of production throughput you were aiming for?

And second and actually on your production ramp. So I was wondering in which sites you're ramping production capacity for the 4680 cell and where you stand on ramping up that capacity as well. And I have a quick follow-up on energy as well if that's possible.

Elon R. Musk - *Tesla, Inc. - Technoking of Tesla*

Well, so we have the -- and Drew can add to this. But we have the -- a small sort of pilot plant, which is still big by normal standards, expected to have like a 10-gigawatt hour per year capability in Fremont, California. And we made quite a few cells. We're not quite yet at the point where we think the cells are reliable enough to be shipped in cars, but we're getting close to that point. And then we've already ordered most of the equipment for battery production in Berlin and then much of it for Austin as well. So we really don't flick the nitty-gritty elements. But overall, I think we still feel quite optimistic about this achieving volume production of the 4680 next year. What do you

think?

Andrew D. Baglino - *Tesla, Inc. - SVP of Powertrain & Energy Engineering*

Yes, thanks. Just one thing I would add is there's been a lot of questions about yields. Actually, I noticed people asking about that. The yield progress has been really strong every day, and we were really still in commissioning phase. We were really still in commissioning phase with most of the tools to the point where we're confident that the yield trajectory aligns with our internal cost projections. We did talk about yield also at Battery Day, which is one of the reasons why it's useful to check in on that. It takes a while, as Elon just mentioned, to go from prototype to production. And it's not just parts. It's processes, it's equipment. But as we've matured the process equipment, we've gotten to where we need to be on the yield side.

Elon R. Musk - *Tesla, Inc. - Technoking of Tesla*

Yes. And basically, this is just a guess because we don't know for sure, but it appears as though we're about 12 -- probably not more than 18 months away from volume production of the 4680. Now at the same time, we are actually trying to have our cell supply of partners ramp up their supply as much as possible. So this is not something that is to the exclusion of suppliers. It is in conjunction with suppliers. So we want to be super clear about that. This is not about replacing suppliers. It is about supplementing the suppliers.

So -- and we have a very strong partnership with CATL, with Panasonic and LG. And we would -- our request to our strategic partners for cell supply is please make us -- please supply us with as much as you possibly can. Provided the price is affordable, we will buy everything that they can make.

Andrew D. Baglino - *Tesla, Inc. - SVP of Powertrain & Energy Engineering*

Yes. Yes. And specific to that, we're on track to more than double the supplier capacity over the next [13].

Elon R. Musk - *Tesla, Inc. - Technoking of Tesla*

Yes, exactly. We do expect from suppliers willing to receive double the cell output next year versus this year.

Andrew D. Baglino - *Tesla, Inc. - SVP of Powertrain & Energy Engineering*

Yes.

Pierre C. Ferragu - *New Street Research LLP - Global Team Head of Technology Infrastructure*

Okay. And I had a quick follow-up on maybe, Zach, for you on your energy business. So I understand like the negative gross margin with Solar Roof ran. But I was wondering what do gross margin look like there when you look at the storage business and where you -- what's your ambition in terms of gross margin in that business as, I guess, it's going to grow in the mix in coming years. So it's important for long-term modeling.

Zachary J. Kirkhorn - *Tesla, Inc. - Master of Coin*

Yes. We're seeing a lot of...

Elon R. Musk - *Tesla, Inc. - Technoking of Tesla*

We're aiming for comparable margins in storage as in vehicle. But it is important to bear in mind that vehicle is more mature than the storage. So -- we're already are at margins with the Powerwall. But some additional work is needed for the Megapack to achieve good margins. Yes, Drew, what do you think?

Andrew D. Baglino - *Tesla, Inc. - SVP of Powertrain & Energy Engineering*

Yes. Sorry, just jumping in, Elon. Absolutely agree. Powerwall is mature. We've been producing Powerwall 2 for 3 years now and we're at good margins there. But Megapack has more room to go to achieve our targets.

Elon R. Musk - *Tesla, Inc. - Technoking of Tesla*

We have a clear runway for improving the cost per the megawatt hour of the Megapack.

Andrew D. Baglino - *Tesla, Inc. - SVP of Powertrain & Energy Engineering*

Absolutely. Yes, we do.

Operator

From Rod Lache with Wolfe Research.

Rod Avraham Lache - *Wolfe Research, LLC - MD & Senior Analyst*

I was hoping maybe just, first, you could talk a little bit about how you're thinking about the rollout of version 9 of FSD and the transition to the subscription model. It sounds like some of this is about to roll out next month. I'm not sure if that's the subscription model, but maybe you could just spend a little time talking about how impactful you expect that to be.

Elon R. Musk - *Tesla, Inc. - Technoking of Tesla*

So go ahead, guys.

Zachary J. Kirkhorn - *Tesla, Inc. - Master of Coin*

Yes, we're working on getting FSD subscription out. There's a couple of internal technical dependencies, but from a business model perspective, that's aligned, and we're hoping to roll that out soon. The key thing that I say here, there's a lot of potential for recurring revenue based on FSD subscription. If you look at the size of our fleet and you look at the number of customers who did not purchase FSD upfront or on a lease and maybe want to experiment with FSD, this is a great option for them.

One of the things we'll need to keep an eye on is a potential transition from cash purchases of FSD subscription over to -- or cash purchases of FSD who may move over to FSD subscription. And so there could be a period of time in which cash reduces in the near term and then as the portfolio of subscription customers builds up, then that becomes a pretty strong business for us over time. But we're hoping to get this launched pretty soon and see what the response is to it.

Rod Avraham Lache - *Wolfe Research, LLC - MD & Senior Analyst*

Okay. Great. And I was hoping, Zach, maybe you can just talk a little bit about OpEx. There was a noticeable increase, even excluding SBC. Obviously, a lot going on this quarter, but can you maybe

just talk a little bit about how we should be thinking about that going forward?

Zachary J. Kirkhorn - *Tesla, Inc. - Master of Coin*

Sure. On the R&D side, what we're seeing, as I mentioned in my opening remarks, is kind of a convergence of a series of programs that are happening. And our R&D OpEx spend kind of correlates to where we are in the product life cycle on different programs. And so we're kind of at the tail end of investments in, what we call internally Palladium, which is the new Model S and Model X. And so we expect that to decrease over time, but it was high in Q1 for a lot of the reasons that Elon had mentioned.

We're also getting very heavy into 4680 development that Drew and team are working on and the associated structural battery pack that goes along with that. And so these are new technologies, not only new to Tesla, but new to the industry. And so we're investing heavily there on an R&D side to work out those kinks. And spend along in those areas should continue over time as we continue to work through the development cycle of those.

And then I also mentioned Elon talked a bit about Dojo and the potential there. So from neural net investments and custom silicon investments, these continue to be areas that we spend on and make investments in.

On the SG&A side, the business is pivoting very quickly to be global. And China is ramping quite quickly. And we're trying to make sure that we are staying ahead of the volume so that we have the right sales capacity, store capacity there, local investments and IT and others to manage the growth, such that as the growth comes, the execution challenges are smaller than maybe in similar periods of growth that we've seen in the past. And so we're making investments there ahead of the growth. And overall, as we looked at OpEx as a percentage of revenue over the course of the year, we do expect to see a substantial drop from 2020 to 2021 as the volumes in the latter part of the year pick up.

Operator

From Dan Levy from CrÃÂ©dit Suisse.

Dan Meir Levy - *CrÃ©**dit Suisse AG** - Research Division - Director & Senior Equity Research Analyst*

Two questions. One is on COGS. I think we've gotten from Battery Day a pretty good feel about the potential for COGS reduction related to powertrain. But I'd like to get a sense of the path to reducing COGS, ex powertrain, as you'd still need a meaningful reduction on that front to make the math work on a $25,000 vehicle. So what levers do you have to reducing your cost, ex powertrain? Is it just more scale, better supplier pricing? Or is it just based on ongoing cost reduction?

Elon R. Musk - *Tesla, Inc. - Technoking of Tesla*

I mean I think all of the above.

Andrew D. Baglino - *Tesla, Inc. - SVP of Powertrain & Energy Engineering*

Yes, I mean on the vehicle side, there's plenty of opportunity as well. Obviously, building a car like a Model S lot is quite complex and has various moving parts. Model 3 and Model Y were steps of improvement in that. But when you look at some of the other advancements that we're including in the Model Y, factories into Austin and Berlin, we've reduced the body count by as much as 60%, and the park cost money. So we continue to find optimizations there as well as we get the

economies of scale when we start to talk about the volumes we're considering worldwide with 4 factories building the same vehicle. So both of those things on the vehicle side will improve our COGS as well, and powertrain continues to be integrated into that.

Dan Meir Levy - *CrÃ©dit Suisse AG - Research Division - Director & Senior Equity Research Analyst*

Great. And then just related. As you see Berlin and Austin ramp, I'd like to just get a sense on the comparison of Fremont versus the new capacity. Obviously, Fremont non-optimized because you bought the old NUMMI facility. You had to retrofit that to your need. So maybe you can give us a sense of how your new capacity is going to differ versus Fremont, what are the areas that you have efficiencies that you previously didn't have and maybe how much does that add up to improved COGS over time to help you achieve that $25,000 vehicle.

Elon R. Musk - *Tesla, Inc. - Technoking of Tesla*

Yes. I think we don't want to talk too much about future product development. The earnings call is not the right place for -- to make major product announcement. So yes. We'll get there, but we'll talk about it later.

Martin Viecha - *Tesla, Inc. - Senior Director for IR*

All right. Thank you very much. Unfortunately, this is all the time we have for today. Thank you very much for dialing in and for listening, and we'll speak to you again in about 3 months. Thank you.

Elon R. Musk - *Tesla, Inc. - Technoking of Tesla*

Thanks, everyone.

Operator

This concludes today's conference call. Thank you for participating. You may now disconnect.

Call participants:

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