Q1 2021 Earnings Call

Company Participants

- Elon Musk, Chief Executive Officer
- Martin Viecha, Senior Director for Investor Relations
- Zachary Kirkhorn, Chief Financial Officer

Other Participants

- Dan Levy, Analyst, Credit Suisse
- Pierre Ferragu, Analyst, New Street
- Rod Lache, Analyst, Wolfe Research

Presentation

Operator

Good day, ladies and gentlemen and thank you for standing by, and welcome to the Tesla's First Quarter 2021 Results and Q&A Webcast. At this time, all participants are in a listen-only mode. (Operator Instructions). I will now hand the conference over to your speaker today Martin Viecha, Senior Director of Investor Relations.

Martin Viecha {BIO 17153377 <GO>}

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 PM 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 Musk {BIO 1954518 <GO>}

Hi, great. Thank you. So, Q1 2021 was a record quarter on many levels as 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 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 Q1. So, Model 3 became the best-selling, let's say 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, it's been exceeded by the Tesla Model 3 and this is only three and a half years into production and with just two factories. For Model 3, the outselling its combustion engine to competitors, I think is quite remarkable. In the the past couple of quarters, we delivered roughly a quarter-million Model 3's. So -- but, which translates to an annualized rate of half a 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. And then with regards with full self-driving, full self-driving is to make great progress, but this 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 -- that sort of AI, the neural net compressed into a fairly small computer, a very efficient computer that we've designed, but nonetheless small computer that's using on the order of 70 or 80 watts. So, this is -- much harder problem if you -- what do you say 10,000 computers in a server room or something like that.

This has got to fit into a smaller and this -- I think with the elimination of radar, we're finally getting rid of one of the last crushers. 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 where team works, it works -- it works better than the best human, because it's like having eight cameras -- it's like having eyes in the back your head besides you head and has three eyes at different focal distances looking forward. This is -- yeah -- and processing at a speed that a super human. There is no question I like that with a clear 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 quite fundamental about artificial intelligence, where we basically have to solve real world vision AI and we are. And key to solving this is also having some massive dataset, so just having well over 1 million cars on the road that are collecting data from very sort of corner case rare situations. Yeah, it's sort of like so many weird things in the world like -- you get back say, a truck carrying a truck or a car with -- one example -- a car with a kayak on the roof, where the kayak has a little weight dangling from the of the Kayak in front of the car and the car must be ignore this and just look at the road. So, it's really quite tricky, but I'm highly confident that we will get this done.

So yes, this quarter, and 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 have ever experienced in the life of Tesla and same difficulties with supply chain, with parts of the -- whole range of parts. Obviously, w learned 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 unable to get a critical engineers there because of COVID quarantine restrictions.

So -- which meant that Tesla worldwide was dependent on driving it's made at our factory in the Nevada -- Giga, Nevada. So, that was a very challenging situation. I think we're mostly out of that particular problem, but that's was just two of many challenges. So, team is really good, done an incredible job, dealing with really severe supply chain shortages.

So with respect to Model S and X, there are more challenges expected in dropping the Plaid Model S, what's called the Palladium program, which is the new version of Model S and X, which has revised interior and a 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 battery was super safe. This was quite hard (technical difficulty). So, it's a quite a bit of part of development to ensure that the battery of the new S and X is safe.

And we're trying to get all the (technical difficulty) in the car 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've booked. But we do expect to ramp Model S production and start delivering them probably next month. So -- and then to be sort of fairly high volume production for BS in Q3, and such and 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, should there be a question ramping supply chain and internal production processes. So, probably we're like -- we're going to aim to produce over 2000 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 just, a lot of factors outside of our control. Here. But I do think these things will get solved, it's just a matter of time and then we'll be doing well of over 2,000 S/X per week. It's a great car. But actually it costs us less to produce, a little bit less to produce, but it is a superior product.

So I mean conclusion there is a lot to be excited about in 2021 and 2022, we're building factories as quickly 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. We are continuing to ramp production of Model Y 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 us here a huge success. Now on to questions.

Martin Viecha {BIO 17153377 <GO>}

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

Elon Musk {BIO 1954518 <GO>}

Okay.

Zachary Kirkhorn {BIO 20940148 <GO>}

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 three key items. First, we successfully launched and began the ramp of Model Y in Shanghai, achieving positive growth 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 have 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 sending the (inaudible) capacities, while the Tesla team in partnership with our suppliers do 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. But 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 mentioned for S and X and expedites and a reduction in global ASPs as our cost structure as a company is reducing even faster pace. So, as we look out over the course of the year, we feel optimistic about our gross margin strength, particularly 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 overheads on energy gross margins, these remains negative for the second quarter, this is driven by Solar Roof 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 plants 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 four 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 quarter 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.

Martin Viecha {BIO 17153377 <GO>}

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 AWS-like business line for Tesla over the next few years?

Zachary Kirkhorn {BIO 20940148 <GO>}

Yeah, I'll jump in here. So with respect to Dojo --

Elon Musk {BIO 1954518 <GO>}

Actually -- sorry my phone was on mute.

Zachary Kirkhorn {BIO 20940148 <GO>}

Oh, go ahead Elon.

Elon Musk {BIO 1954518 <GO>}

So, yes, basically saying that the -- although like right now people think of Tesla as -- Tesla is a car company or perhaps an energy company. I think long term people will

think of Tesla as much as and AI robotics company as we are car a company or an energy company.

I think we are developing one of the strongest hardware and software AI teams in the world. So I mean -- we appear to be able to do things with full self driving that others cannot. So -- and if you look at the evolution of our technologies we developed -- we develop them in order to solve the problem of self-driving. So, we can find a powerful enough neural net computer so we designed and and bought her on. 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 just sort of make sense, this is kind of what needs to happen because the road system is designed for a neural net computer, our brain. Our brain neural net computer. And it's -- the entire system is designed for vision with neural net computer, which is because it's designed for eyes and a brain. And so if you have a system which has very good eyes, you can see in all directions at once, you can see three focal points ahead or forward, but it's never gets tired, it's never sort of texting, it has redundancy and it's reaction time is superhuman. Then it seems pretty obvious that such a system would achieve an extremely high level of safety far in excess of an average person. So that's -- that's what we're doing.

Then Dojo is kind of the training part of that. So -- because we have over a million cars and perhaps next year we'll have two 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 develop a lot of training software, a lot of labeling software to do -- to be able to do, surround video labeling which is quite tricky. This means all eight cameras simultaneously at 36 frames 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 -- the trainers train the training system and then the system auto labels the data and then the human labelers just need to look at the labeling to confirm that it is correct and perhaps make edits. And then every time an editor's make, that further trains the system. So, it's kind of like a flywheel that's just spinning up and really the only way to do this 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 Sergio will be probably an order of magnitude more efficient on the say -- I 'm not sure the exact right metric is, but it's a per frame of video.

We think it will be an order of magnitude more cost efficient in hardware and in energy usage for frame of video compared to a GPU-based solution or compared to the next best solution that we're aware. So, then possibly that could be used by others. It does seem as though over time, I mean, just an observation -- I think it is the fact that neural net based computing or AI-based computing is a more and more of the compute stack. Conventional computing is perhaps heuristics based

computing is -- so going to be important -- so going very important that it will become -- neural net will become a big and bigger portion of compute. So, all right, that's a long story, but I think probably (inaudible) want to use it to and will make it available.

Martin Viecha {BIO 17153377 <GO>}

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

Elon Musk {BIO 1954518 <GO>}

Yeahm first, I should say that the demand for the Solar Roof remains strong. So, despite raising the price, the demand is so significantly in excess of our ability to -- to meet the demand to install the Solar Froofs. So production is going fine, but we are chocked at the installation point. We did find that we've 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 two or three times easier than other roofs. So you just can't have a one size fits all situation. If a roof has lateral protuberances of if the roof sort of the core structure of the roof is rotted out or is not strong enough to hold the Solar Roof, the the cost can be double, sometimes three times what we -- what our initial quotes were.

So in those cases what we obviously have to do is to refund customers their deposit and -- what we cannot do is go and just lose an absolute amount of money, we just got to provide a refund of the deposit, But that's what is I think most important about the solar situation, which I treated about past week is that we are shifting the whole -- the whole sort of solar situation. So the solar Powerwall basically solar plus battery situation to -- there is only one product basically or there's only one -- one configuration, every house -- we will not sell a house solar without a Powerwall.

That's solar could either be solar retrofit -- what's conventional panels put on a roof or it can be the Tesla Solar Glass Roof. But in all cases, it will have the Powerwall tool technically, but this is actually Powerwall 2 plus if you will. And the plus opposed to a higher peak power capability. So, basically all Powerwall has made since roughly in November of last year, have a lot more peak power capability than the specification on the website. It's never about twice -- the power capability roughly. it's not how you count power, but if not twice the peak power and about arguably twice the steady state power of the specification of the website.

The energy is same, but the power is roughly double. And old installations -- so old installations will have the Powerwall and the the difficulty installation will dramatically include -- the difficulty of the installation will be -- will be much less, it will be much easier because the the power from this from the Solar Roof -- Solar Glass Roof or the

the solar panels will only ever go so directly into the Powerwall. And the Powerwall will only ever go between the utility mains -- between the utility and the the main power panel of house, which means you never need to touch the main circuit breakers of the house. You have 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, it is the only way to do it really. And this also means that every solar parallel installation that the house or whatever the case may be will be its own utility. And so even if all lights go off 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 Powerwall to stabilize the overall grid. So let's say if there is a, blackout that was in Texas, there was a peak power demand and the peak power demand because the grid lacked the ability to buffer the power. They had to shut down power. There is no power storage -- no good point power source. However, with how much of Powerwall and houses, we can actually buffer the power.

So if the grid needs more power, we can actually with the consent obviously of the homeowner and partnership with 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 if you will actually understand this, but this is extremely profound and necessary, because we are headed towards a world where as we just talked 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 -- they will need to be a bunch of wallet coming somewhere. In fact, if you go for full renewable electricity, we need about 3 times as much electricity as we currently have.

So these are rough numbers, but roughly need twice -- roughly twice as much electricity if the transport goes electric and then you need 3 times as much electricity or heating goes electric. So basically this is a prosperous future, both for Tesla and for the utilities because -- and in fact, I guess this will be very -- if this is not done utilities will fail to serve their customers, they won't be able to do it. They won't be able to wrap faster. And we're going to see a more and more of what we see in California and Texas, of people seeing brown outs and blackouts and you saw not being able to respond, because -- because there is a massive change going on with the transition to electric transport and we're seeing more extreme weather events. This is the rest of (inaudible) you put asset. So it is very important to have solar and batteries at the local level of the house.

In addition, it is important to have large battery storage at the utility level. So that solar and wind, which is the main forms of renewable electricity can be -- that electricity can be storage because sometimes the wind doesn't blow and I was lot, sometimes worse too much, sometimes no well enough, but if you have a battery, you can stores 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, specifically as we talk

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

Martin Viecha {BIO 17153377 <GO>}

Thank you very much. And the next retail question is (inaudible). Can you tell us anything about Tesla's future plans in digital currency space or when any such major developments might be revealed?

Zachary Kirkhorn {BIO 20940148 <GO>}

Sure. Thanks, Martin. So, as I noted in our opening remarks and we've announced previously. So Tesla invest $1.5 billion into Bitcoin in Q1 and then we subsequently sold a 10% stake in that. We also allow customers to make the vehicle deposits and final vehicle purchases using Bitcoin and so where our bitcoin story began, maybe just to share a little of the 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. You know 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 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 beings 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 is a lot of reason to be optimistic here. We're certainly watching it very closely at Tesla and 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 in the Bitcoin market. So our ability to build our first position happened very 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 markets 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. You know specifically with respect to things we may do 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 is one to come, we'll certainly let you all know.

Martin Viecha {BIO 17153377 <GO>}

Thank you. And the fourth question from retail investors says, 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, perhaps specialty PR job of some sort?

Zachary Kirkhorn {BIO 20940148 <GO>}

Well, I'll take this one guys. From the safety side, I continue to say --

Martin Viecha {BIO 17153377 <GO>}

Yes.

Zachary Kirkhorn {BIO 20940148 <GO>}

Go ahead Elon.

Elon Musk {BIO 1954518 <GO>}

Please go ahead. It's I think such worth just going through the effects of the -- what I mean specifically, there were -- there was an article regarding a tragedy where there was high speed accident in Tesla and there was really just extremely deceptive media practices, where it was claimed to be autopilot, but this is completely false and those journalists should be ashamed of themselves. Please go ahead Zachs.

Zachary Kirkhorn {BIO 20940148 <GO>}

Yes, thanks Elon. So I was just saying, we're committed to safety in all our designs and that's number one in what we do here. Regarding the crash in Houston specifically, we work directly with the local authorities NTSB or 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 it auto steer did not could not engage on the road condition that as it was designed our Adaptive cruise control only engage on the 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 adapted infusions control does engage the car slowly to complete to stop when the driver's seat belt was unbuckled. Through further investigation of the vehicle and accident remains, we inspected the NTSB and the local police and we're able to find that the steering was indeed deformed, so there was -- we need to likelihood that someone was in the driver seat at the time of the crash and all seatbelts post-crash were found to be unbuckled. We were unable to recover the data -- from the date the SD card at the time of impact with 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 {BIO 17153377 <GO>}

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

Zachary Kirkhorn {BIO 20940148 <GO>}

Yeah, 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. The vampire drain is -- maybe not --

Elon Musk {BIO 1954518 <GO>}

As mythical as Vampires.

Zachary Kirkhorn {BIO 20940148 <GO>}

Yes, yeah, I think, I think the challenge with seasonal storages is your value proposition drops from hundreds of useful full cycles per day -- per year to less than maybe 10 or you may be in less than five cycles per year. So, it's just a different type of technology altogether that would make sense given that it's more than order of magnitude different use case.

Elon Musk {BIO 1954518 <GO>}

Yeah, we 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 on the side of subtly latitudes and then across a variety of longitudes. So essentially let's say in the US for example, if there was -- I'm not sure understands that you can actually power the entire United States with just sort of hundred roughly, a 100-mile by 100-mile grid of solar. So, I know people don't quite understand like how much Solar is needed for the United States. Almost nothing (technical difficulty) of almost any country in the world. The solar incident is a gigawatt per square kilometer. This is insane. In fact if you took the clear area -- just the area -- we're seeing for nuclear power plants, the area that is considered not usable because of nuclear power plants there. In most cases, if you just put solar there, it would generate more power than in the nuclear power plant because they typically have a 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're laid out, you're going to do about 200 megawatts per square-kilometer.

Therefore, (inaudible) kilometers is gigawatt, which might be a typical sort of power plant, it really not much area at all. And a lot of places can have wind and solar in same place. So -- anyway it is entirely possible to power all of it with a small percentage of earth's area. And then to transfer that power through high-voltage DC lines with no new technology. No, no -- you don't need like room temperature superconductors, this is also another myth. Roof temperature superconductors are almost irrelevant in my opinion. Low-cost long distance power lines using copper or aluminum or that's very important. So, heating is I squared R. So, that's current square two times resistance. So as you increase voltage, you can drop the current dramatically and drop the heating dramatically to a point where it is of minor relevance, but maybe you lose 5% to 7% with a high-voltage DC power, something like that.

So, I wanted to clear no (Technical Difficulty) is necessary, we just need to scale this thing up. The technology exists today to solve renewable energy. And some of you will say, well, why do we do, that's because the energy basis of the Earth is gigantic, super mega insanely gigantic. So, you can't just go and do a zillion terawatts overnight. You've got to build the production capacity for the cells, for the battery cells, for solar cells, you've got to put that into vehicles, you got to put them into stationary storage pads, you got for them for solar panels and Solar Glass Roofs and you got to deploy all the stuff. But we 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, I think most economist would agree is to have a carbon tax, just as we have a tax on cigarettes and alcohol, which we think are more likely to be bad than good we intend to tax fruit and vegetables less. The same should be true. We should tax energy that we think is probably bad and support energy which we think is probably good, just like cigarettes and alcohol versus fruits and vegetables. It is just cognizant. And -- on the plus side, I must just anyone being complacent, but sustainable energy, renewable energy will be sold, it is being sold, but it matters, how fast we solve it and if we solve it faster, that's better for the world.

Martin Viecha {BIO 17153377 <GO>}

Thank you very much.

Elon Musk {BIO 1954518 <GO>}

There is no question in my mind whatsoever that the energy storage problem will be solved with lithium-ion batteries, zero. I want to be clear, zero. I think the bias will tend to be towards ion-based lithium ion cells. So (inaudible) look you still might think look it much be a big (inaudible) 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 math and cost in the cell is the cathode. For high energy cells, like for example what we use in most cathodes have nickel-based lithium-ion cells, which have higher energy that's the longer-range iron-based cells. However, stationary storage, the energy density is not as important, it's just sticking [ph] to the ground and so I think the vast majority of stationary storage will be iron-based lithium-ion cells with an iron cap -- iron phosphate cathode technically. But only the phosphate part is not necessary so i the iron or nickel. I'm misreading [ph] the terminology. Just to think it was iron or nickel

and this is an insane amount of iron in the world, more iron than we've possibly use and it's also more lithium than we could possibly use. Basically there is no shortage of anything whatsoever in iron plus lithium cells.

Martin Viecha {BIO 17153377 <GO>}

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

Elon Musk {BIO 1954518 <GO>}

I think we'll, so we're still -- we're still quite far away from it. I mean, the thing to bear in mind with production is for those who have not never done production, they just don't understand how insanely hard production is. I want to be very, very emphatic here, prototypes are trivial. They're child's play. Production is hard, it is very hard. Now you say production at very large scale with higher reliability and low cost is insanely difficult. But what has been 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 has to basically have several aneurysms to get this done. It was so hard to no idea.

So anyway -- and the thing about making a large complex maintenance object is -- let's say you have trust order approximation 10,000 unique items, even one of those items is slow, let's actuate, just one. It does not matter how so trivial. We've had production -- production stopped because of carpet in the trunk. We have production stopped because of a USB cable. At one point for Model S, we literally raided every electronics storage in the Bay Area for a few days there nobody could buy a USB cable in the Bay Area because we were to (inaudible) put them in the car, literally. And there's like hundreds of stories like that. So anyway, that's solving that -- those constraints and logistics problem that makes World War II look trivial. I'm not kidding. Look the scale is insane. We talking millions of cars, so put massive global supply chain, 50 countries, dozens of regulatory regimes, it's the same. So yeah.

Martin Viecha {BIO 17153377 <GO>}

Thank you. And last question from institutional investor is Master Plan Part 2 talks about 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?

Zachary Kirkhorn {BIO 20940148 <GO>}

No this time.

Martin Viecha {BIO 17153377 <GO>}

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

Questions And Answers

Operator

Thank you. First question is from Pierre Ferragu with New Street Research. Your line is open.

Q - Pierre Ferragu {BIO 15753665 <GO>}

Hi guys, thanks so much for taking my question. I'd love to get back to you an update on what you presented on the Battery Day. In the last six, seven 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 products you throughput you are aiming for? And second, actually on your production ramp. So I was wondering in which sites you're ramping production capacity faster with 4680 cell and where you stand on ramping up that capacity as well? And I have a quick follow-up on energy as well.

A - Elon Musk {BIO 1954518 <GO>}

Well, so we have -- add to this, but we have the small solar powered plants, which is still (inaudible) expected to have like a 10 gigawatt hour per year capability in Fremont, California. And we're (inaudible) 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 Poland and then much for Austin as well. So we really don't like the nitty-gritty elements, but overall, I think this is quite optimistic about this achieving volume production of the 4680 next year.

A - Zachary Kirkhorn {BIO 20940148 <GO>}

Yeah, thanks Elon. Just one thing I would add is, there's been a lot of questions about yields. Actually that is people asking about that and you know, the yield progress has been really strong every day, but we were really still in commissioning phase to the tools to the point we're confident that the yield trajectory aligns with our internal cost projections. We did talk about yield also a better. It 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 prototypes to production and it's not just parts, it's processes it's equipment, but as we've matured those process -- the process equipment we've gotten to where we need to be on the yield side.

A - Elon Musk {BIO 1954518 <GO>}

Yeah. And basically, this is just a guess because we don't know for sure, but it appears as though we are above 12 -- probably not more than 18 months away from volume production of 4680. Now at the same time, we are actually trying to have our cell supply 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 yes, we -- we want to be super clear about that. It's not about replacing suppliers, it is

about supplementing suppliers. So we have a very strong partnership with with JBL, with Panasonic and LG. And we would -- our request to our the strategic partners for cells supply is, please make -- please supply as much as you possible can, provided the prices are affordable, we will buy everything that they can make.

A - Zachary Kirkhorn {BIO 20940148 <GO>}

Well, yes, yes and specific to that we're on track to more than double that supplier capacity over the next (inaudible).

A - Elon Musk {BIO 1954518 <GO>}

Yes, we exactly -- we do expect from suppliers going to perceive double upward next year versus this year.

A - Zachary Kirkhorn {BIO 20940148 <GO>}

Yes.

Q - Pierre Ferragu {BIO 15753665 <GO>}

Okay. And I had a quick follow-up on maybe Zach for you on your energy business. So I understand, like when I get you gross margin with Solar Roof ramp, but I was wondering, you know what do gross margin mix like there? When you look at the storage business and where are you -- what's your ambition in terms of gross margin in the -- in that business? I guess going to grow -- to grow in the mix in the coming years? So excited the bottom for long-term modeling?

A - Zachary Kirkhorn {BIO 20940148 <GO>}

Yeah, we're seeing a lot of -- I think for comparable margins in storage as in vehicle, but bear in mind that vehicle is more mature than the storage. So we already are at good margins with the Powerwall, but some additional work is needed to put the megapack to achieve good margins.

Operator

Thank you.

A - Elon Musk {BIO 1954518 <GO>}

Yeah -- sorry just jumping, absolutely agree Powerwall is mature. We've been producing Powerwall too for three years now and we're at good margins there, but Megapack has more than we got to achieve our target.

Q - Pierre Ferragu {BIO 15753665 <GO>}

But we have a -- we have a clear runway for improving the customer, the megawatt hours of the megapack.

A - Elon Musk {BIO 1954518 <GO>}

Absolutely, yes we do.

A - Martin Viecha {BIO 17153377 <GO>}

Thank you. Let's go to the next question please.

Operator

From Rod Lache with Wolfe Research. Please go ahead.

Q - Rod Lache {BIO 1528384 <GO>}

Hi, everybody. 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 subscription model? It sounds like some of this is about to rollout next month. I'm not sure if that's a subscription model, but maybe you could just spend a little time talking about how impactful you expect that to be?

A - Elon Musk {BIO 1954518 <GO>}

So you're going again?

A - Zachary Kirkhorn {BIO 20940148 <GO>}

Yeah, we're working on getting FSD subscription out and there is 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 is a lot of potential for recurring revenue based on FSD subscription. The -- 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 cash purchases of FSD who may move over to FSD subscription. And so there could be a period of time in which, no cash reduces in the near term and then as the portfolio, subscription customers build up. Then that becomes a pretty strong business for us over time. But we're hoping to get this launch pretty soon and see what the responses to it.

Q - Rod Lache {BIO 1528384 <GO>}

Okay. Great. And I was hoping, Zach, maybe you can just talk a little bit about OpEx. It was that noticable 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?

A - Zachary Kirkhorn {BIO 20940148 <GO>}

Sure. On the R&D side, what we're seeing, as I mentioned in my opening remarks is kind of a convergence of the series of programs that are happening. In our R&D OpEx spend, correlates to where we are in the product lifecycle and 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 has mentioned. We're also getting very heavy into 4680 development that Giga and team are working on in 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. So, we're investing heavily there in an R&D side to work out those things. 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 in 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. In overall as we look 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 pickup.

A - Martin Viecha {BIO 17153377 <GO>}

Thank you. Let's go to the next question, please.

Operator

From Dan Levy with Credit Suisse. Your line is open.

Q - Dan Levy {BIO 17519730 <GO>}

Hi, good evening. Thanks. 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 X Powertrain. Is it still need a meaningful reduction on that front to make the math work on $25,000 vehicle? So, what levers do you have to reducing your cost X Powertrain is just more scale better supplier pricing? Or is it just based on ongoing cost reduction?

A - Elon Musk {BIO 1954518 <GO>}

Sure. I mean I think it will be about. Yeah, I mean on the vehicle side, there is plenty of opportunity as well. Obviously building a car like a Model X. It's 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 reduced the body (inaudible) as much as 60% in the park cost money.

So we continue to find optimizations there as well as we get economies of scale. When we start to talk about the volumes are considering worldwide with four factories building the same vehicle. So, both of those things on the vehicle side will improve our COGS as well in the Powertrain continues to be integrated into that.

Q - Dan Levy {BIO 17519730 <GO>}

Great. And then just related as we see Berlin and Austin ramp. But 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's 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, maybe how much does that add up to improved COGS over time to help you achieve that $25,000 vehicle?

A - Elon Musk {BIO 1954518 <GO>}

Yes, I think we had already talk too much about future product development. Earnings call is not the right place for it's like make major part announcement. So, yeah, we'll get there. We'll provide it later.

A - Martin Viecha {BIO 17153377 <GO>}

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

A - Elon Musk {BIO 1954518 <GO>}

Thanks everyone.

Operator

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