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J.P. Morgan Global ESG Virtual Conference

Company Participants

- Bob Holycross, Vice President, Chief Sustainability, Environment and Safety
- Peter Carlsson, Co-Founder and Chief Executive Officer

Other Participants

- Chetan Udeshi, Analyst

Presentation

Chetan Udeshi {BIO 15787698 <GO>}

Hello. Hi, everyone. I am Chetan Udeshi, the head of European chemicals equity research at JPMorgan based in London. Welcome to the session today focused on Batteries and Mobility focusing on our fast-moving value chain. I'm delighted to have two of the speakers who are experts on this field. I've got Peter Carlsson, CEO and Co-Founder of Northvolt; and Bob Holycross, Vice President, Sustainability, Environment and Safety Engineering at Ford Motor Company. Hi, Peter. Hi, Bob. Thanks for joining us for the session today.

Peter Carlsson {BIO 17371409 <GO>}

Thank you.

Bob Holycross {BIO 21337443 <GO>}

Thanks for having me.

Questions And Answers

Q - Chetan Udeshi {BIO 15787698 <GO>}

Just to introduce the panel in terms of the format, it's going to be more like a Q&A session where I will start with a few questions, few topics. And then there is an opportunity for participants to ask a question. I think there is a button on the webcast that you guys all are seeing to send us any questions that you might want to be addressed. So with -- on that note, maybe we should start on the more lighter note and just in terms of maybe Peter and Bob's, how -- what is your sort of expectation on say EV penetration outlook, say in 2025, 2030. We hear different numbers, but will be great to get your perspective on how are you guys thinking about the ramp up of EVs as we see over the next five years to 10 years. Maybe, Bob, if you want to go first and then we can follow up with, Peter.

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A - Bob Holycross {BIO 21337443 <GO>}

Sure. Yeah. Thanks, Chetan, again for having us, and it's great to be here with you as well, Peter. So, yeah, I mean this is the kind of the magic question. And in the crystal ball everybody is trying to have in terms of what the ramp-up is going to continue to be. And certainly this is a very exciting time in the industry with a lot of new products that are coming out and strategies around how we get the overall electrification ecosystem ready to go. It's going to be key as well.

So for us at Ford, our focus is working on electrifying what we call our most iconic vehicle nameplates, the ones that resonate most with our customers and can have the most impact. Because if we're obviously going to get to turning the fleet over in the significant volumes and have the penetration we're talking about and expecting by 2030 or 2035, it's going to have to really be on the products that resonate most with customers and can have the most impact.

So for us this year we debut our Mustang Mach-E, which has been a real exciting products at the marketplace, the reviews event fantastic and we're all excited about it at Ford. So this is how we demonstrate that not only can you get the benefit of zero emissions and all-electric, but you can also deliver the performance and the functionality and the fun to drive that goes along with that. And we know that's going to be a key thing to continue to change the mindset of broad-based consumers you know beyond some of the early adopters or what have you.

And then again for us as well, we look to later this year, we're going to introduce our transit, commercial van all electric. And this is a really important product, because when you think about the opportunity across fleets and commercial applications and for us at Ford, where we have a significant share of the market, not just in the US but globally as well in this space. We have an opportunity to have a real impact with that product. And the same thing for our F-150 pickup, which again when you think about being able to electric -- fully electrified product like the F-150 provide the functionality and cargo carrying capacity and the other attributes of customers in these segments have come to demand. That's where we're going to see the opportunity have a real impact.

So we're going to be ready, what the date is, or what have you will see, but it certainly won't be for lack of having the right products being ready to go. Beyond the products, obviously, which is our focus, it is going to be how quickly does the infrastructure develop, how quickly are the other policies put in place that are going to be needed to continue to attract consumers to these products. And then even just more broadly whether it's in the US or Europe or in Asia, what are the broader incentives around manufacturing and supply chain and how these things all work together so that we have seamless integration up and down the value chain to be able to deliver these products in a timely fashion. So we're focused on that as well.

And the solutions are going to be different, depending on the different vehicle applications as I mentioned. For retail, it's going to be one type of the solution. Customers want to understand what kind of range capability they need, the technology that's been available and batteries and everything else is starting to make that equation

more palatable for most consumers may think about the range they need. But for commercial customers that may be a totally different solution, right, where routes are more fits the work that needs to be done, is more defined and they may not need the bigger batteries that in some cases retail customers do. So it's been a real interesting journey for us. We're really excited about the products we have coming this year. And looking forward to continuing to partner with our partners and government in the supply chain to really get this going.

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Q - Chetan Udeshi {BIO 15787698 <GO>}

So you don't -- you didn't tell us what your crystal ball shows in terms of specific numbers, but maybe we can come to that separately. Peter, how are you thinking about sort of EV penetration outlook from (Multiple Speakers)?

A - Peter Carlsson {BIO 17371409 <GO>}

Yeah. Well, I start with the crystal ball, and obviously, if you look at the numbers where we're using internally, we say, somewhere between 13% to 15% in 2025, and somewhere between 32% to 35%, maybe even 40% in 2030. But you have to look at this from three aspects. One is, you know the regulatory where we see -- we see China clearly stepping in a very clear path towards 2040, end of combustion engine. And thereby you need to be significantly over 50% penetration in China by 2030. I think Europe on a regulatory side is hovering also somewhere between 2035 to 2040, in terms of when the last combustion engine is going to be sold.

And then I would say US is a little bit more of an [ph], an open question on how regulatory will drive. So there is clearly -- there is a clearly on end of life and then so that on a number of major markets on the regulatory side. What you then see is on the customer demand side, how will the customers act. And I think here this is a little bit more, a difficult to predict, but what we clearly see is 2023, 2024, 2025 is really when we starting to see product portfolios at -- with the car companies that is really ranging up to meet a broader not just the premium segment, but the broader consumer or a broader consumer group.

But then you also have -- you also have the situation and what is the pre and post COVID, I mean, if you take just in, in Stockholm, where I'm sitting now in Sweden, in December, every third a vehicle that was sold in Sweden was an electric vehicle and the most sold vehicle was actually an Volkswagen ID 3, which is the total trend shift. So I think you know as people and consumers is starting to get their head around that there will be a total phase out of combustion engines, then you also get the investment decision. You know, do I dare to buy a combustion engine in my next buying decision, which means that I think that you could actually see the flip switch much earlier than the regulatory, which would then indicate even a larger penetration specifically between 2025 and 2030, on the electric side.

The third factor here is, what's the supply chain availability of supporting this major overhaul. And here I think this will be a massive effort in both Europe as well as in US, I think China have come -- have a headway here versus Europe and US in establishing the supply chains to support this major transformation in raw materials, in components, in batteries, modules and everything there is. So I think you have to look at all these factors,

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but it's every time we look at the numbers they have a tendency of going up, specifically over and going up pretty fast.

Q - Chetan Udeshi {BIO 15787698 <GO>}

Understood. Maybe I think you know the point you made, Peter, about a large scale up that needs to happen in Europe and the US to ensure that we get to those numbers that you quoted. But you know what would be the challenges that you would say are critical in terms of scaling up the EV penetration to the mass market levels, while ensuring that the sustainability and the carbon footprint profile of the whole EV production chain don't reduce the intended benefits of the transition to electric vehicles. So I mean this is a very open-ended topic. So what are the key points that you would want to maybe flag in terms of just profile in terms of sustainability of the ramp up of the supply chain?

A - Peter Carlsson {BIO 17371409 <GO>}

Maybe Bob, I could start on the battery side, and then you can look at the whole platform side. Obviously, on the battery side, there has been a big focus in Europe, in order to establish a reasonable amount of battery factories, in order to support this, the European Union founded the European battery alliance, looked at what is the bottlenecks and we now see a number of initiatives both from Asian, the major Asian players, but also from European players in terms of building cell manufacturing. It's still not sufficient, but it's clearly underway. And what we're also seeing is that a year or two ago there was a challenge in capital allocated towards this part, but we are also seeing a very, very strong trend of financing becoming available for this scale up as the market gets more and more comfortable with that, this transition really happen.

What the next bottleneck comes here is actually competence, competence on the customer side, on the battery side, and on the supply chain. I think a number of the initiatives that you're going to see in both in Europe as well as in the US, the biggest challenge will be enough skilled engineers to develop product, to develop processes and industrial license scale up, because this is really, really hard to do, and it's not readily available in all over. So there is initiative going on, but this is going to be a scarcity here as we.

The third one is around the supply chains. 95% of all lithium hydroxide is being processed in China. If you look at the manufacturing of graphite for anode manufacturing there is very, very tiny in Europe, I'm not even aware in the US and a huge concentration in China. Electrolyte, a number of these key components, raw materials were -- where we need to also look at the massive investments into building supply chain supporting this. So these are some of the bottlenecks that, that will be done.

And it's important that we do it in a very, very sustainable way, because batteries and its supply chains is consuming a lot of energy, roughly I mean to build one kilowatt hour of battery cell with the active material you consumes somewhere 80 to 100 times the amount of energy. And if you do, if you -- I mean it would build up the supply chains in cold-based economies such as China. And we transformed the entire vehicle industry. We are trying to solve one problem, which is getting oil out of transport, but we were also creating a new carbon footprint, the size of half Germany's, in -- if we're not doing it right. So it's

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important that we are decisive in investing, but we also do it in a very, very sustainable way.

Q - Chetan Udeshi {BIO 15787698 <GO>}

Bob?

A - Bob Holycross {BIO 21337443 <GO>}

Yeah, I think those are -- Peter made some great points. And yeah, from the vehicle manufacturers point of view, Chetan to your question, yeah, I mean that the benefits of EVs, right, when you think about and when they're on the road right zero emissions or what have you is significant. And in the process, right, we do have to look at a whole lifecycle when you think in terms of the circular economy all aspects that go into this, because to your point we don't want to solve one problem in and create another.

And for Ford, the journey that we've been on more broadly in terms of sustainability and the strategies we have around that, we've been at this for some time. And so when you kind of look upfront and you look at manufacturing processes overall, we've been on a journey to work towards powering our facilities globally with a 100% renewable energy. We have that target by 2035. We've achieved that. And in many different areas, not only in the US, but in other parts of the world as well. And that is key. That is a big piece of this. Because as Peter mentioned, the structure when you think about the manufacturing of batteries and some of these other things in the energy intensity, we need to be able to have facilities that are ready to go and you don't get ahead of that as well.

The other key piece obviously is the materials that go into the products, right. So not only just in terms of making sure we've got the right materials from a -- the CO2 intensity of producing them or the impact that they have on the environment, but just in terms of where these materials come from in responsible sourcing and making sure that we're all collectively looking out for the human side of this, and that is going to be all of us working together through our supply chains or what have you.

So at Ford we've partnered with the Responsible Business Alliance, the Initiative on Responsible Mining Assurance and others to really look at best practices, because this is a common interest that all of us have and we're going to need to work together. And with some of the technologies that we have like blockchain and other things to be able to really trace the pathway for some of these materials. We think that's -- that's going to make a difference.

And then when you think about what happens to these vehicles and batteries in the like -- at the end of their life, and what opportunities that are out there. And you know the good news is, there's a lot of components of the electrified vehicle system that are recyclable. But what are their secondary used applications from the batteries play into it at the end of their life electric vehicle. Do you think about stationary source applications in terms of what can be provided to power buildings or even battery storage for the greater we have you, there is -- I think some exciting opportunity.

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If you think about what the vehicles themselves can do when they're not on the road, in terms of providing stationary power. We had episodes in the US here most recently with some extreme weather events in the South and Texas where the failure the greater would have you led to some significant power outages and people were actually able to use their F-150 hybrid electric vehicles that have generators on board to power their homes and some of their needs there. And when you think about how more sophisticated that can become, our vehicles may have the opportunity to do bi-directional charging that can also help with managing electricity load.

And the other thing too, when we think about the technology that's going to be on these vehicles again beyond just the zero emissions piece of it, but the connectivity and other things and how smart the vehicles are, you know in terms of being able to do we call smart charging so that you're charging the vehicles during off peak hours and times and whatnot. That's going to all be a piece of this that contributes to the overall impact, if you will.

So we're really excited about the opportunities both upstream in the manufacturing processes and the opportunities we're going to have to do there. Making sure we have the right practices up and down the supply base with the governance that we put in place in terms of partnering with suppliers and in doing those audits and using these alliances to share best practices, it's going to be key. We have set a target to be carbon-neutral globally by 2050 in line with the peer support. We have a history of our alignment with the peer support not just most recently. And we're going to have to continue to -- as I say partner together to get to these solutions that are going to be needed whether it is making the electricity grid globally more robust ongoing use of more penetration of renewable energy to responsible sourcing of materials.

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Because when we get these vehicles produced in and around the world, the benefits are significant. And it's not just CO2 and greenhouse gases, when you think about smog forming pollutants and where vehicles operate in industrial centers or ports or other areas where communities in some cases may be more challenged in terms of area quality. We can't let those benefits and opportunities will be overtaken by some of these other challenges we're talking about in. Some of the best minds in the industry and in companies like (inaudible) I think there is a real opportunity to partner together and get at some other things that we're talking about here.

Q - Chetan Udeshi {BIO 15787698 <GO>}

So maybe just following up on that point and this is one question that we've also received from an audience, which is where are we in terms of the recyclable, so recyclability of these used batteries in the long-term? And how are you guys adopting or incorporating recyclability of these batteries in your planning process of may be producing batteries or just from Bob's perspective launching more EVs and selling more EVs in the future. Maybe Bob, do you want to go first this time and then we come to Peter?

A - Bob Holycross {BIO 21337443 <GO>}

Yeah, sure. I mean when you think about recyclability, as I mentioned, I mean there is a significant part of batteries that are recyclable today, right. And when we think about

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some of the policies as well that governments are put in place in terms of -- in the light vehicle requirements and the operations and processes to collect batteries and ensure anything that has to be disposed or mishandled in the appropriate way, but then also the opportunity is to put them back into the production of other components or batteries in new batteries or what have you. We're looking at all of those aspects.

But the secondary use in terms of, as I mentioned potential stationary source applications or whatever, that's something we're looking at as well, it's fairly new, but it's going to -- I think take a lot of different thinking in terms of how we make sure we're doing all these different initiatives and ways to help the overall business equation in this space was that and your user disposal again in the most responsible way.

Making sure, right now for Ford, our targets are around zero waste to landfill. We've achieved that and over 80% of our facilities in manufacturing. Globally, we have been seen want to maintain that and are working towards a 100% as well. So when we think about what are the other opportunities in this space to get even after that last that, that can be used in different ways we haven't even thought of today that's certainly something that we're going to be keeping our eye on and looking for opportunities as well.

A - Peter Carlsson {BIO 17371409 <GO>}

Okay. And if I jump in and add on to your -- I think the recyclability is really, really good. So that's a good starting point. I was actually looking this morning reviewing with my team on how we are constructing our first large-scale up of the fully recyclable plant where we are basically taking the batteries, we are discharging them, dismantling the bags with them, grind them into a black mass and then use a hydrometallurgical process, which is not mainstream today, but we think it's going to grow. The mainstream process today is that you put the black mass into a smelter and then you separate the cobalt and nickel. But the bad thing with that is, you lose lithium in that process with the hydrometallurgical process, you can actually also regain lithium and lithium hydroxide into the process.

And we are now, as we're doing pilots in this, we are thinking we can achieve over a 90% recyclability. And the good thing is also like in, for example, if you compared to aluminum, you know, if you want to do crush structure with aluminum, you really have to have super pure aluminum in your structure, which means that you can only have a percentage of recycled aluminum versus prime aluminum. But in batteries actually, when we are -- when we are hydrometallurgically separating these raw materials and we can actually create a nickel salt, the cobalt salt, a lithium hydroxide that is as pure as the prime material. And thereby there is no need to balance in order to get the product performance. You can get and ask good new battery from a recycled battery as from prime material. And I think this is very, very promising.

I think also just comment a little bit on what Bob said on Second-Life, and one of the things we're seeing with the new technology that the higher performance battery cells. One of the things you do in order to achieve that is you're making harder and harder surfaces between at the anode and the cathode, in order to have lesser and lesser degradation. But what you are basically doing is almost like sapphire glass on a watch. You have very little degradation for quite a long period of time. But then when you're

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starting to get micro cracks, you know the whole glass cracks pretty fast. So you're seeing a little bit of a changing degradation curve where you have pretty for a long period of time, very little degradation. But then you have a very rapid, which makes we think that a lesser appetite for the new generation of batteries to be used in Second-Life because of that rapid degradation when it starts to degrade. And thereby, it's more -- it's going to be more profitable to bring it into recycling immediately.

And another thing that we're seeing there is, today, if you're a carmaker to put a battery into disposal is a cost, a disposal costs. And 2025 and onwards when we're starting to see this in scale that cost is going to be turned into a value because the battery is clearly valuable from a raw material, which means that there is going to be significantly also higher incentives to take care of also from the OEMs to create circular flows where they can benefit of that value towards the battery makers and thereby building new batteries out of old batteries. So I think -- I think we will see this circular flow becoming more and more effective as we are both regulatory but also as we scale this industry.

Q - Chetan Udeshi {BIO 15787698 <GO>}

Good. Maybe just shifting the sort of topics a bit too just around battery technologies, chemistries, and we hear number different terminologies and pardon me audience, if you don't know, but we hear typically NMC, NCA, LFP solid state. I think the crux of the question is, do we really need a standardization of the whole battery industry to sort of achieve the kind of cost reductions that are necessary to achieve a mass market adoption of EVs like we have say for instance the 4G standard and telecoms are now 5G. Do we need certain sort of standardization of the battery industry to achieve the kind of cost curve that we would want to beat or we would want to achieve a mass market penetration of electric vehicles. Maybe Peter, if you want to go --

A - Peter Carlsson {BIO 17371409 <GO>}

Yeah. I mean, let me -- let me start. I mean one of the things we clearly see is that more and more order companies are starting to develop two electrical platforms; one for high SUV like vehicles and one for lower transportation vehicles and where the objective is to build as much energy into the Skateboards as possible. And as you're seeing these platform develop different carmakers had a little bit different philosophies around wheel sizes or axle sizes and things that drives a bit of differentiation. But we clearly see that this platform thinking is really, really starting to drive scale. It do drive a certain uniqueness. You can either kind of use like Tesla, a cylindrical format or you can as many others using larger cell formats and thereby developing custom formats that fits towards the platform. But because it is a platform, the economies of scale is getting there anyway. We are starting to see some of the OEMs, I think -- we're starting to see some of the OEMs kind of projecting that this field [ph]. Once you're established these platforms, you're talking about the 100 gigawatt to 200 gigawatt hours on a platform, which means two, three Gigafactories fully built in order to support the platform and then you clearly achieve scale. So from that angle, I think we are starting to see a strategy where we will create an optimization.

If you then talk about new technology -- new technology coming such as solid state and different types of new chemistries, I think the challenge here is going to be how do you

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get these technologies into the scalability and the processing capabilities that is required by these platforms. So I think you will see just like we acquired a company Cuberg here a couple of weeks ago, they are developing a battery with the lithium rich electrode and the lithium-based anode, which had very high performance, but the first applications is towards aviation undrawn. And we are -- there is a willingness to pay a higher cost for that performance, but we clearly see that we think we can take this technology into the type of mass market, the mass volume of automotive may be in five years. But it needs to evolve over time. And I think we're going to see that with other types of chemistries.

However, I think it is -- you're going to also have to adhere to the fact that it is platforms vehicle OEMs, don't want -- a security of supply is super important. So it needs to be either multiple factories, multiple suppliers on those platforms. So to be totally unique on something might not be a benefit when you're wanted to reach these volume markets.

Q - Chetan Udeshi {BIO 15787698 <GO>}

Bob, do you want to add --

A - Bob Holycross {BIO 21337443 <GO>}

Yeah. I think from my perspective --

Q - Chetan Udeshi {BIO 15787698 <GO>}

Yeah.

A - Bob Holycross {BIO 21337443 <GO>}

Yeah. No, I think Peter covered it very well. I mean those are all the real critical considerations. I mean for us, as I was talking about earlier, right. When you look at the different use cases and applications and the platforms, as I mentioned both on the retail side and on the commercial sides the needs could be different, right. In terms of what the overall architecture the vehicle may look like or even the use cases from the customer side, right. Like I mentioned earlier in some cases, it's not just about having more range or what have you but you know more on the packaging considerations. There is a number of different things that have to be considered.

So we're really excited about the advancements that have been made. In terms of the flexibility, it's giving us in terms of the different applications on the vehicles. But the other important point that Peter made was on the security of the supply. As we've seen in different cases, you see what's happening with semiconductors and other things. I mean if we have these disruptions because we don't have a robust supply and logistics value chain in terms of how batteries are developed and where they are developed and what the technologies are to be able to support. Then it's going to only sell things that much more.

So all these pieces are going to have to come together. And for OEMs when we look at even beyond batteries, whether it's motors and transactions [ph] and the like everybody is kind of looking at the different opportunities in terms of how they integrate things with

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healthy partner with suppliers. And we're continuing to look at that as well. But we're really excited around the functionality and the opportunities that the advancements in the battery technologies, whether it's the chemistry or some of the other aspects are going to allow us to do in terms of serving all of our different customers' needs. And ultimately just increase the business equation for these products that much more. It's such an important piece of it.

Because again when you think about the other things that have to come along with the battery technology around the charging infrastructure and how batteries respond in those different cases, it's going to be really key to have to make sure those pieces are developed in conjunction and are compatible everything else in that respect. So I think it's going to be a really important development to see how these different technologies come together and picking winners or losers at this stage is probably premature because I think there is a lot more opportunity. But as I said it's good to see what's been coming through so far.

Q - Chetan Udeshi {BIO 15787698 <GO>}

Very clear. We've got some time for questions from participants. So if there are any questions please post them on the web now. We've got a couple of questions. One is, just around the charging infrastructure point that you mentioned, Bob, and the question is, isn't real bottleneck the charging infrastructure given most people own a car currently neither have the possibility to charge it at home, nor in the office, and it still takes much too long to charge on the go. So I don't know if you guys had any perspective on how are you guys say charging infrastructure needs to double up over the next few years for clearly EVs to happen. Is there some sort of a tipping point in terms of maybe the time it takes to charge or the availability of the charging infrastructure that we need to reach that tipping point before we can think about the kind of numbers we have all in mind in terms of EV penetration?

A - Bob Holycross {BIO 21337443 <GO>}

Yeah. I'm happy to start, I mean just in terms of our experience. In the US, in particular, we've been working over the last several years to build out our charging network for our customers, we call the Ford fast charging networks. So our customers today have access to over 16,000 charging stations across the US, right, through partnerships that we've done with Electrify America, Green Lights and others. So that, again that there is an excess net includes fast chargers and different applications in that way.

I just took delivery like Mustang Mach-E whatever they had for the last several weeks. And I've actually been challenged to try to deplete the battery all the way down, because I can plug in at home. And it is a mindset shift I think customers are going to have to (inaudible). I appreciate that not everybody is going to have that capability, right. When you look across different countries and different applications whether it's multi-unit dwellings or what have you workplace charging as you mentioned the same solutions aren't going to be available for everybody.

But as we get into these different battery technologies and the ability to with fast-charging to charge-off really fast, I think it's going to help with this issue of range anxiety and it's

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going to recognize that maybe some of the original concerns around access and frequency may not prove out to be as dramatic as anticipated, but that doesn't stop us from continuing to get the infrastructure there. You know, and it's going to take partnerships as well in Europe, Fords partnering with the German OEMs and others in our IA&DT charging base network again to provide customer solutions there and it's going to take those kinds of partnerships all over. And then again the at-home charging solutions as well.

The other thing I just wanted to plan on the vehicle side too, in terms of again how smart the vehicles are and their connectivity. As I was looking at different long distance trips, I may be able to take with my electric vehicle. They can now tell you precisely down to, on your trip, here's the charging station you need to go to. This particular station has this much power. You only need to be there for 15 minutes, you know, then you can drive another X number of milestone behalf our this one would have you and really optimize how that trip planning can be. And the smarter the vehicles are the smarter the infrastructure is, I think it's only -- it's going to help continue to get out this concern about am I going to really be able to have the energy supply that I need.

So I think it's going to be really, really key. And as I mentioned before on the commercial side, it's going to be different. When you think about depose and having charging availability there that's going to be different than what a retail solution is for X number of charging stations at a workplace or a shopping mall or a parking structure would have you. Those vehicles right have to be up nearly 24/7. So the charging solutions there may be different. And again it gets back to the discussions we are having on the battery technology and how that can play in for these different applications. But again I think the more experiences that customers are having and the security they're going to get with the technology that some these vehicles these solutions will hopefully play out even sooner than any of us expected.

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A - Peter Carlsson {BIO 17371409 <GO>}

So if I may just jump on, I have two concerns, I mean it's not about the charging pole, because the chargers in itself is a pretty easy installation and in most cases the grid is already there. So it's a fairly scalable model, since we have that the infrastructure in place. The two things that bothers me is, number one is driving around obviously from my background I used to drive around with Tesla's in the US and the super charger network was absolutely awesome. Now I'm driving around with the German electric car and thereby I move between different types of charging infrastructure. And every time I have to download a new app, I have to create the new payment proposal or solution et cetera. It absolutely drive me nuts that there is not a common payment platform for charging, but that you need to have and a page of different charging apps in order to get around. This one I think just for the ease of customers we just need to fix.

The second one is a little bit more challenging. And that is the grid challenge. And if I just take an example, if you take Stockholm, Stockholm have roughly 2,400 megawatts of power into the city. And 40% of that -- of the time which is day time, those is a 100% utilized. When we are getting into the electric vehicle revolution, even with like a 30% penetration of vehicles into Stockholm, the peak power increase in Stockholm by just charging these is probably going to be asking for a 50% increase in peak power.

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Q - Chetan Udeshi {BIO 15787698 <GO>}

Well.

A - Peter Carlsson {BIO 17371409 <GO>}

They accumulated, but the peak power during -- which means that we either need to dig up the entire city and build a heck of a lot of copper or we need to be really building energy storage solutions to bring in energy during night hours in order to use in charging during day and peak hours. And this one I don't see the planning and I don't see the pro-activeness happening because this is much, much longer lead times than establishing the charging poles. And as customers in many cases want a 50-minute charge, a 50 minute charge of 100-kilowatt hour battery. That's a lot of power specifically when you're adding multiple vehicles to do this. So it is the payments and it's the infrastructure not the poles that worries me that we are not doing more here to make it easy for the electric vehicles.

Q - Chetan Udeshi {BIO 15787698 <GO>}

I mean with that unfortunate to be run out of time, but this was a fascinating conversation. Thank you both Bob and Peter for joining us, and thank you all the audience for participating. Have a good day. Speak soon. Bye.

A - Bob Holycross {BIO 21337443 <GO>}

Thank you very much.

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