PGIM FIXED INCOME

Fixed On ESG, Ep. 6

Transcript

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Female Voice: You're listening to Fixed on ESG, a monthly podcast series brought to you by PGIM Fixed Income, an active global fixed income investment manager.

Alistair Shepheard-Walwyn, Investment Analyst and ESG Specialist: Hi, and thanks for joining us for today's episode of Fixed on ESG. The plan is to talk about two potentially momentous pieces of legislation coming out of the United States. These are California's Internal Combustion Engine Vehicle Ban, and the Inflation Reduction Act. Both promise to transform transport in the USA, so we're going to dig a little deeper into the two pieces of regulation and discuss the effects these could have, both from an ESG perspective, as well as some effects on the credit of affected autos manufacturers. Now, there are lots of details to get through, but fortunately, I'm in great company. Today I'm joined by two of our fantastic credit analysts, John Smigelsky, one of our principals, and Megi Leka, one of our senior investment analysts who both cover autos amongst other sectors for our US and EU investment grade credit research teams respectively. My name is Alistair, your host for today, and an ESG specialist at PGIM Fixed Income. Now, with all that out of the way, let's jump into the regulation. At the end of August 2022, California regulators voted to ban new in-state internal combustion engine passenger vehicles sales completely, from 2035. The ban would introduce a requirement for the annual zero emissions vehicle for proportion of sales for autos manufacturers in California starting at 35% in 2026, and increasing to 100% in 2035. To be clear, this isn't going to prevent Californians from owning gasoline powered cars, or buying them on the used car market. And the regulation also outlines plans to accelerate the deployment of EV charging infrastructure, help find access to EVs for demographics within California, and to develop more public transport and active travel infrastructure with the specific goal that this will target low income and disadvantaged communities. So, all new cars sold in California in 2035, will be EVs. But the regulation goes further than that. It even starts to set some standards on how these cars should function. By model year 2030, EVs will need to maintain at least 80% of electric range for ten years, or 150,000 miles. In addition to that, powertrain components will need to be under warranty for at least three years, or 50,000 miles. There are other similar provisions, but basically, factories will need to keep working for longer. What's particularly exciting is that we don't need to wait and see 49 other states follow suit for this to change the autos market in the USA. Fifteen states followed California's previous zero emissions vehicles regulations, and could adopt the 2035 ban, too. The expectation from a spokesperson for the Californian governor is that the majority of these states will actually follow. So, that's already potentially 16 states, but there's more. In 2019, California accounted for 11% of new car sales in the US. That's a substantial stake alone of the US autos market, which could start to further incentivize action from automakers. The second piece of regulation is the Inflation Reduction Act. It's equally exciting, but much, much broader than the California ban. Unfortunately, we will only be able to discuss a small segment of it today so that we have time to get into some of the details. But it is safe to say that it is amongst the more impactful pieces of US policy making. It provides tax credits for electric vehicle purchases based on two

criteria: critical mineral extraction and processing, and battery component manufacturing, or assembly. Each requirement is associated with a $3,750 tax credit. So, if you met all of the necessary conditions, you could qualify for a $7,500 tax credit. These are difficult criteria to meet. And we'll discuss in a bit more detail later just how high the bar has been set. The upfront summary is that when these changes come into place, very few, if any vehicles will be eligible, and that may be a bit confusing. In what world does it make sense to provide a tax credit that cannot be claimed? Well, part of the explanation, and something it is very important to understand, is that the tax credits provided by the Inflation Reduction Act serve two purposes. One purpose is to promote EV uptake. The second is to bring more of the global EV supply chain into the USA, or more accurately, take it away from China. For that second reason, US policymakers might be thinking more long-term, and recognizing that maybe no cars will be eligible when these tax credits are first available, but the credits could provide an incentive to move. For example, [inaudible] processing away from China. We're already hearing from some manufacturers that they are developing or at least accelerating plans to invest in moving their operations to the US as a response to this act. One final note to add is that the act also provides a $4,000 tax credit for used EVs, which promises to have a positive social impact by helping the sections of society that don't buy new cars as much. That's enough from me for now. Hopefully that's helped lay a bit of the groundwork to understand these regulations. But let's now look to our experts in autos. John, if you wouldn't mind kicking off, how do you think this will affect some of the names you cover?

John Smigelsky, CFA, U.S. IG Credit Research Analyst: Thanks, Alistair. So, looking at this from the perspective of the major domestic auto producers that I cover, I think the most significant credit impact from the California mandate will be acceleration of the trends that are already taking hold of a transition to electric vehicles, except now with more pressure on management teams to execute against the deadline, or potentially a series of incremental deadlines, as the mandate kicks in. So positively, this isn't something that came out of the blue. These companies have already been investing large sums of money to transition to EVs, and have laid out internal targets for electric units, some of which line up fairly nicely with the California timeline. So, for instance, General Motors has already communicated a target of eliminating emissions from vehicles by 2035, but assuming they execute on that, they would already be on track to hit the California mandate. Ford has been a little less ambitious, with a target of 50% of global units to be EV by 2030, and that includes 100% of European passenger vehicles. So, somewhat less implied in the United States. So, a 100% EV mandate for California would raise the stakes for these companies whereas an internal target can be changed, and the largest impact might be the reaction in the financial markets. And with this law in place, you have potential fines or lost sales, if you're not able to comply with the mandate as it stands. Just drilling a little bit into the direct credit impacts an EV rollout [inaudible] the two buckets on the more negative side. First, there's just a huge amount of capital committed to build out EV production capacity. And this includes things like the engineering and the technology expenditure, but primarily in capital spending on new production facilities, converting legacy facilities to produce EVs, and a more recent development constructing battery plants to ensure sufficient supply of cells, and even new and further upstream into the investments and commodities that go into the battery production. And just to put some numbers to this, GM has committed to 35 billion of technology spend between 2020 and 2025, while Ford is maybe playing a little bit of catch up, and they plan to spend 50 billion through 2026. So, at this point, the legacy automakers are essentially using cash flow generated from their internal combustion businesses from these new investments in EVs, with the sheer amounts being spent or a major call on capital here. The other bucket I would say is on the production cost side. And given small initial production volumes and the high cost of batteries, EVs are expected to be lower margin than internal combustion vehicles at the offset, if they're able to generate a profit at all in the beginning. So, another example here is the Ford Mustang Mach-E, the company's highest volume EV at this point. Initially, management said they expected the model would be profitable to start. However, after the

cost of inflation over the past year plus, now they said it's more like break even. And this is a vehicle that starts at around $50,000. So, on top of all the cash being spent to lay the groundwork to produce these vehicles, at least in the early years, they aren't going to be very [inaudible] to profits. And this has been the major impediment to rolling out a massed produced, affordable EV to this point, where the battery is. So, it's such a significant cost. Now, I don't currently cover the EV market leader, Tesla, but it's worth mentioning, I think it's more on this picture for them, maybe? So, on one hand, Tesla's already established in the market. So, they had that first [inaudible] bandage, and demand for their product is going to have to grow significantly, particularly if the other auto makers aren't able to make the transition to [inaudible] the volumes needed to supply California and these other states. So, on the other hand, the mandate is forcing increased competition. Previously there was little for them, and also providing financial incentives to catch up. So, maybe more on the positive side, these financial incentives provided in the IRA are another meaningful consideration here, and potential benefit to auto makers. These include not only the purchase incentives to the vehicle buyer, but also certain credits available to the auto makers who produce batteries or battery materials. These can help with demand and affordability on the consumer side, as well as help on the product cost side as the automakers begin to take advantage of this integrated battery production that they're revving up. Maybe just lastly, there's some potential opportunity here for the domestic auto makers as GM and Ford are both underpenetrating in California and largely the group of states that follow, compared to their national market share. If you think about the vehicle mix right now, GM and Ford both make a lot of money on their full-size pickup trucks and large SUVs. California tends to be skewed more towards cars than the nation as a whole, and has a little share of pickup trucks as a percent of their total vehicles. So, while it's still a meaningful number of sales for these companies, this transition could allow them to reach customers who may not have previously been considering them. Maybe you can compare a Tesla with an electric Cadillac, or a Mustang Mach-E, where you wouldn't necessarily be comparing it with a gas engine F150 or Silverado for these buyers. So, there is potential for increased penetration of these markets for the big domestic auto producers. Management teams have also said that significant percentage of reservations for the EV rollouts, are customers new to the brand. So, there could be some credence to this penetration argument.

Alistair: That's great. Thanks a lot, John. I was particularly struck by what you said there about this being sort of broadly in line with what manufacturers' existing targets are. So, some of the research I was looking at was showing that 2026 cap for California was actually in line with industry's expectations for sort of EV -- new EV sales in that year. One thing that I'm sort of struggling with a bit I guess is trying to understand whether this is really driving ambitious change, or if it's more just sort of putting a floor on it and then showing the progress with rolling out EVs isn't slowing down or sort of slipping in the future. I'm not sure if you have any thoughts on that? But it's something I thought was quite interesting.

John: And so, California has been a major growth market for EVs, and I think they have close to half of the EVs currently in operation in the country right now. But as you look into the later years and you need more of a wide scale of vehicles to supply the market, I think it maybe does seem pretty ambitious, though I'd also note that we're at the early end of the technology curve. It's more than a decade until it fully kicks in. There could be some rapid advancements that help along the way. I think there's a number of obstacles that need to be overcome to transition to 100% electric vehicles, both on the auto makers side, and also things that are outside of their control. One of the big ones we've already mentioned is the cost of vehicles, and to hit 100% EV, you'll need more affordable models than are currently available. And for this to happen, we need to bring the battery cost down substantially. And this will require advances in technology, increased manufacturing efficiencies, and more suppliers of materials that go into the batteries. Another aspect of this affordability will be maintaining access to those customer purchase incentives that we talked about. Built into the IRA will be

sourcing requirements both for the battery components, and the battery raw materials. And you'll need to have increasing amounts sourced from the U.S. or the Trade Department. So, if the auto makers aren't able to preserve these incentives for vehicles, that'll be an added cost to the consumer and put them at [inaudible] disadvantage, which then leads to another potential bottleneck, is securing supply of these needed battery materials. I think with the announcements that have been made recently, we're likely on our way to having enough battery cell capacity in North America, but it's going to require a growing amount of minerals [inaudible] with the [inaudible] graphite, nickel, cobalt. Auto makers are currently working on supply agreements, joint ventures, and partnerships while trying to ensure that they have the needed raw materials, but this will have to be a key focus as we move forward. Outside of the auto makers supply chain, there's also a number, maybe California specific factors, they'll have to consider as they ramp up. One of these would be the charging infrastructure. In order to drive adoption of these vehicles, you have to have a dense, reliable network of chargers that an ease concerns about rain, charging time. Along with this, there will likely need to be upgrades to the electric grid to make sure it can handle the increased load from all the new EVs. And as we've seen recently, California's experienced drain on the grid due to high demand in these heat waves. So, improvements there will need to be made. And then lastly, as the U.S. ramps electric vehicle penetration, at the same time Europe and China are doing the same, there'll be a global need for more battery materials. That'll require new mines, and processing facilities. That could take multiple years to get up and running. And again, there's more than a decade before the deadline to work through these issues, but it's definitely going to require [inaudible] investment, technological advancement, cooperation between government and the auto makers.

Alistair: Thanks, John. Some very interesting points there. In particular, you mentioned the demand for critical minerals, and I'd like to refer our listeners to one of our previous podcasts called Low Carbon Crossroad, in which James Malone [phonetic] discusses how we see the market for these metals evolving in the future. Another interesting point you made there was about the cost of EVs. And there's a crucial distinction to make when talking about the cost of EVs, which lays between the up front cost and the ongoing cost to the buyer. As far as the ongoing cost of EVs goes, they are on average, cheaper than internal combustion engine vehicles across their lifetime. A 2020 study from the University of Toronto, found that using May 2019 electricity and petrol prices in the USA, electric vehicles cost about half as much as their internal combustion engine counterparts, per kilometer, to run. We reproduced some of this analysis using more up to date electricity and petrol prices, and found that in the USA, they cost on average about a third of what an internal combustion engine vehicle would cost to run. And we got roughly the same results for the UK because despite the current natural gas crisis driving up domestic electricity prices, price of petrol has increased roughly proportionately. Another type of ongoing cost is the cost to repair and maintain the car. Here again, EVs are cheaper on average across their lifetime, primarily due to having about a third of the number of components and moving parts, and therefore needing repairs much less frequently. An important caveat to note here is when they do need repairs, especially if the battery's damaged, then the repair costs can be really, really high. So, they need less frequent, but more costly repairs, and on balance, that comes out as being cheaper than the average internal combustion engine car. Recent estimates by a group called the Consumer Reports, which is an independent nonprofit, put the savings on repair costs as around 50% across an EV's lifetime. These cheaper ongoing costs could be particularly impactful from an ESG perspective because it's often the poorest households that spend the largest portion of their income on transport and on fuel, maintenance and repairs for their cars. In the USA in 2021, lower income groups were spending about 11% of their income on running their cars, whereas the average household spent much closer to 4%. Other types of ongoing costs are influx right now, and it's hard to see where they're going to settle. Insurance costs and lease costs for example, are products of the price of electric vehicle components, and the residual value

of the vehicles in a few years' time, both of which could change quite drastically as the technology used in these vehicles continues to develop. They're also affected by the fact that the technology's relatively new and quickly evolving. Mechanics that learn to service combustion engines 15, 20 years ago, can still draw on that knowledge today if a conventional car came in for maintenance. By contrast, when it comes to servicing EVs, that same knowledge base is not yet as established, and as people learn the new skills and knowledge required, we could see the cost of things like repairs falling further. Broadly speaking, despite these uncertainties, the message is that there's potential for EVs to provide really quite substantial income savings to the people that need it most. Unfortunately, the up front cost of EVs tells a bit of a different story. Compared to the average internal combustion engine car, they cost a lot more. For example, and I found this quite shocking, the average used EV in June 2022, cost double the price of a conventional used car. What's more, the cost to purchase a new EV has been rising steadily over time. So, the average starting price of a battery electric vehicle in 2020 was about $62,000, compared to roughly $42,000 in 2012, ten years ago. Cheaper ongoing costs are fantastic and could really help people that need cheaper transport, but unfortunately, the high up front cost of EVs currently put them out of reach to the people that stand to benefit the most. Now Megi, we haven't heard from you yet. What are your thoughts on this? How do you see some of the names that you cover being affected?

Megi Leka, Sr. European IG Credit Research Analyst: Yes, just to touch on the affordability piece. It's worth noting, the majority of the new battery electric vehicles in the market thus far, have tended to be higher end models, and that's because manufacturers are trying to maximize the profit margins on the cars sold. As John also said, it's no surprise that battery electric cars are less profitable than petrol or diesel ones, but we think that as the technologies become more efficient and unit sales ramp up to a level where manufacturers get [inaudible] benefits, we will begin to see a wider variety of price points in electric cars as well. And a lot of the EV price is attributed to raw material costs. So, one key answer to this would be finding a way to recycle materials. In Europe, positively we've seen OEMs such as VW launching targets to recycle as much as 95% of the components of batteries. However, the proof of this is still very limited. The earlier sales of battery electric models will be reaching the end of their eight-year battery warranties by 2029 or 2030. So, such initiatives will be scaled up for the end of the decade, but this is one key feature to meaningfully reduce the cost of production and then [inaudible] price to customers going forward. From a strategy perspective, European OEM, the Californian ban is not bad news. Generally, the market share of German OEMs tends to be limited, below 5% across the US. Although the target is to improve this as they are early movers in the EV market. So, in fact, we could see this benefit them in the US. The story isn't so clear for the Japanese manufacturers. Collectively, Toyota and Honda account for around 29% of California's new vehicle market. However, the [inaudible] is still relatively in material for the individual companies. The main question remains, "How many other states adopt California's rule, and whether it could be stopped in its tracks?" If New York, Massachusetts, and Washington do follow California's suit, [inaudible] for around one-third of the American auto market, which then becomes much more significant for these OEMs. Both companies have begun to introduce more BV heavy initiatives, but despite that, meeting the state's target is likely to be a challenge, especially as they try to close the gap with global peers on battery electric vehicles. [Inaudible] to require speed up in R and D and cap [inaudible] spending from already high levels. The Honda has committed to $46 billion of R and D and cap [inaudible] for the next six years, and Toyota, another 19 billion in BV alone, by 2030. That said, both are starting out with record levels of cash on their industrial balance sheets, so we think they're fairly well-positioned from a credit perspective to tackle these challenges. Another point is that the new roles do offer some flexibility as up to 28% of sales can be plug-in hybrids. And this is an easier transition for Japanese OEMs that have a more hybrid approach to the energy transition. The saving grace also is that these Japanese brands are mass market brands, and that that also appeal to middle America,

not just the cost that tend to move faster on [inaudible] policies. We firmly believe that demand for such brands will continue, given the price advantages. The pressure's definitely mounting for them to push the pedal on BVs. Despite [inaudible] and the transition overall, we see Honda's and Toyota's targets to reach about 80% BV penetration by 2035, and 0 COT emissions by 2039, as in line with the regulations. Now, the Inflation Reduction Act is probably a little more [inaudible] to the Asian mass market players, particularly Hyundai. The European OEMs tend to have higher average sale prices, and therefore, wouldn't be eligible for the tax credits at all. Most of the foreign car manufacturers that sell material units in the US, have already localized production for petrol and diesel cars. So, we would expect a similar move on BVs as well. The truth is that short term, there is little the manufacturers can change, since investment plans are already in place, but we could see this act accelerate those plans. However, the localization of battery materials in the US, remains a questions. Not only because battery technology is mostly done in partnership with Asian technology companies, but also because most critical materials are not sourced or processed in the US. One example of that is cobalt, a raw material that's crucial to battery pack production, and two-thirds of which is sourced out of the Democratic Republic of Congo and [inaudible] in China. It's important to note that neither of these countries has a free trade agreement with the US, and thus wouldn't qualify for the Inflation Reduction Act. Several manufacturers that we cover have said that battery supply out to 2026, has already been secured, and for the most part, the sourcing is done entirely by the battery manufacturer, rather than the car company. So, this is going to require significant review of their supply partners, and a cost benefit analysis of the [inaudible] required to set up facilities are going the attractive yet still relatively limited EV credits, a percentage of EV sales prices. Overall, we expect the impact on credit spreads related to EVs and emissions to manifest itself over a long investment time horizon. And we think policies like the California ban will only accelerate the time to differentiation.

Alistair: Thanks for that, Megi. Very interesting to hear what you said there about the eligibility for the tax credits in the Inflation Reduction Act. I saw some estimates from the EV research group that said about 70% of the EVs currently sold in the US are ineligible for the tax credits because of conditions around the assembly location, and the suggested retail price. And that's before you even look at the two requirements about the source of the minerals and where the battery was manufactured. It's going to be interesting to see if manufacturers feel the tax credits provide sufficient incentive for them to complete the overhaul of their supply chains in the way that would be required to make them eligible. Now, we heard from John about how the California target compared to US auto makers' ambitions. Megi, could you give us your perspective for the names that you cover? Do you think European OEMs are on track to hit the 2035 target?

Megi: Yes, I think the European OEMs are quite well-positioned, because regulation in Europe tends to be stricter as well. In Europe, the EU Commission put forth several carbon emissions targets for OEMs, along with associated penalties if they failed to deliver. In 2021, this initiative was tightened further with targets to reduce average CO2 emissions by 15%, by 2025, against a 2021 baseline, and fully ban the sale of diesel and petrol [inaudible] vehicles by 2035. I think most local manufacturers are on track to meet these targets based on their internal emissions. So, for example, Mercedes Benz Group is potentially the most ambitious company under by coverage, with a target for all unit sales to be battery lectured by 2030, as long as the market allows in terms of infrastructure. The other key money factor is -- are similarly ambitious on Europe, although target closer to 50% penetration in North America by 2030. So, I think with these internal [inaudible], we consider firms committed to pure battery electric vehicles strategy the best position for the [inaudible] change. The majority of EU countries have set their own ICE phase-out plans, with the bulk set for 2030. So, Europe in general continues to be a few steps ahead of the US in terms of regulation and the [inaudible]. But important to say that it's difficult to mention Europe as a leader without mentioning China.

China has faster adoption of EVs overall, and it has also established greater control in the supply chain for electric vehicles from the sourcing of rare earth's to refining and the chemical engineering needed to supply batteries. For that reason, I think China will continue to play a big role in the current and future battery technologies, and the pace of adoption.

Alistair: Thanks. And now I feel it would be remiss of us not to go into some of the -- the sort of more obvious ESG positives of EVs. And so, I think the one that sort of is most evident to you is the life cycle emissions of these vehicles. You know, the -- as I said earlier, they're described in the regulation as zero emissions vehicles, which is a bit misleading, and I'll get onto that. But from a greenhouse gas emissions perspective, these vehicles are better, and it's worth mentioning that. They're better when you're using them. So, when they're driving on the road, you're obviously charging them with electricity rather than burning petrol in them. And that produces no emissions through a tailpipe. But also, when you look across the whole life cycle, you know, these cars get built, they run for a number of years, and as people sort of own them and use them, and then they get scrapped or recycled hopefully. And across that whole life cycle, EVs are also better than their internal combustion equivalents. We should note that they're worst during the production phase. So, the emissions intensity of mining the metals you need and constructing the batteries is actually worse than the emissions required to build an internal combustion engine car, but they make up for that across their life cycle. Again, another caveat there is it does depend where you're running this vehicle. So, there was some really interesting analysis done by VW, which used 2017 data, and they found at the time if you owned their E-Golf in China, it would actually produce 30% more emissions than driving the diesel version of the Golf, simply because of China's electricity's mix at the time. Fortunately, you know, as the world moves to decarbonize its electricity generation, I'd like to hope at least that you won't see that in the future and that you know, these vehicles are just going to be cleaner across their life cycle. But it's worth paying attention to that. And I think the point of that is, you know, road transport emissions are a tenth of global carbon equivalent emissions. So, the potential that EVs cut into that stake, is going to be a huge step in whatever the global response ends up being to the climate crisis. And I think that's why we're seeing it getting pushed quite so hard by policy makers. I mentioned earlier that I wasn't super happy with the term zero emissions vehicles, and the reason for that concerns air quality. Air quality has been an issue with road transport for a while, and the pollutants that cause particular concern are called nitrogen oxides and particulate matter. Fortunately, EVs completely solve the worries around nitrogen oxides. That's a group of gasses that get released when you burn petrol or diesel, gasoline for our American audience, in an engine. And EVs don't burn anything in an engine, and so they don't spew nitrogen oxides out of their exhaust pipe. Surprisingly, the story for particulate matter is not so simple. Currently, somewhere between 60 and 85% of fine particulate matter does not come from an exhaust pipe, but instead, from things like tires rubbing on the road, brakes clamping down on brake disks, and even from the air currents in the wake of a car, resuspending small pieces of particulate matter that had settled on the road surface. Manufacturers and policy makers have been focused on reducing emissions from the exhaust pipes of cars, and they've done so quite successfully. But that has meant that these other sources have been slightly overlooked. Now, we would expect their focus to shift, and we'll be keeping an eye out for who is able to lead the market in reducing the air quality impact of EVs. I'm going to leave it now on air quality, because we have this fantastic [inaudible] called Focused on EVs that explains a lot of this. And that should be available when this episode goes on air. But to summarize, my point here is just that EVs are not from an environmental perspective, perfect. They are great for GHD emissions, and they are an improvement for air quality, but that's not the whole story. One final point I wanted to cover is about alternative transport and how it could potentially threaten EVs. During COVID-19, we saw many cities worldwide restrict cars from entering certain areas, and re-pedestrianize large sections of the city. These changes were motivated by a need for increased space, and it makes sense that it was from cars

that the space was taken. Parking infrastructure is estimated to cover more than a third of total land area in US cities. As this space was converted for pedestrian use, and as you might expect, the public benefits were almost immediately realized. Fine particulate matter levels are estimated to have fallen by about a quarter across New York City, as over the two month period from the middle of March to the middle of May 2020, millions of people suddenly stopped driving their cars and trucks around the city. Unfortunately for our auto makers, the momentum behind pedestrianized cities doesn't seem to have disappeared as the pandemic has become more manageable. So, sticking with the New York example, the mayor, Eric Adams, has endorsed a plan calling for 25% of New York street space to be re-pedestrianized by 2025. According to the plan organizers, this would almost double the pedestrian space in the city. Same initiative has been replicated in Los Angeles, but it doesn't really seem to have the same momentum there yet. Looking across to Europe, in 2021, the mayor of Paris unveiled plans to make the city 100% cyclable by 2026. Here again, the catalyst for the ambition seems to have been COVID as the plan explains that around 50 kilometers of cycle lanes were added during COVID, and now 130 additional kilometers will be added throughout the plan's lifetime. So, across the next four years. In emerging markets where you've got these urban areas that are growing incredibly quickly, it's less-likely that people have access to the required resources to invest in a private vehicle, let alone these really expensive EVs, and the equipment required to charge them. So, my point with all of this is that cities are beginning to rethink the way people travel within their borders, and that could have substantial implications for the auto industry. Keeping track of which manufacturers stand to gain from these sorts of transition, and which don't, is important now more than ever. Nevertheless, and I should mention, there are significant hurdles to overcome before transportation in cities can change. One example of these hurdles, I'm focusing again on the USA, is that there way and continues to be, a huge amount of money, both public and private, being directed towards private cars and their supporting infrastructure. For as long as that investment flow continues, it's unlikely that the current transport model gets disrupted or replaced. So, for some figures on that, between 2017, federal, state and local government combined spent $1.2 trillion on mass transit and rail, compared to $3.4 trillion on highways. On top of these substantial investments, the private sector's contributing, too. So, in 2021, the auto industry spent over $125 million on lobbying in the US. For comparison, the railroad industry spent around $25 million. You won't be surprised to learn, it is the manufacturers with the lowest EV ambitions that are generally most opposed to climate policies that would affect the auto industry. Pedestrianization measures in cities are an example of this sort of policy. So, we've discussed the Californian ban of new internal combustion engine vehicles from 2035. We mentioned the Inflation Reduction Act and how it could provide incentives for EV rollout, as well as for manufacturers to relocate portions of their supply chain. Thinking about how this affects our corporate names, as John and Megi explained, for some manufacturers, the regulation is broadly in line with manufacturers existing targets, so it's not particularly worrying to any of the names that we cover. However, there is a lot that remains uncertain. How policy makers respond to our growing understanding of the harm caused by air pollution, how the economics of battery recycling evolves, and how cities reform their transport models following the pandemic, or as they grow, are just a few of the many factors that will affect the outlook for auto manufacturers going forward. We will be keeping a close eye on these issues, as well as on the ESG topics that will affect EVs and their manufacturers. Thank you Megi and John for joining me today, and thank you to our listeners very much for tuning in. I hope you found some of our discussion interesting, and please look out for future episodes of Fixed on ESG, that will be available in all of the normal podcast places.

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