PLANES, TRAINS AND AUTOMOBILES: ELECTRIFYING EVERYTHING

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OPENING REMARKS AND KEYNOTE SPEAKER

- Josh Boone, Veloz, Executive Director
- Gabe Klein, Joint Office of Energy and Transportation, Executive Director

OPENING REMARKS AND KEYNOTE TRANSCRIPT

Josh Boone, Veloz: Good morning everyone, and welcome to Veloz's first Summit Series event of the year that we've titled Planes, Trains and Automobiles: The Electrification of Everything.

My name is Josh Boone and I'm the founding Executive Director here at Veloz. My team and I are thrilled to bring you a full agenda today with to-the-point and punchy panels about the broader world of transportation electrification. This summit expands Veloz's reach beyond our typical focus on electrifying light duty passenger vehicles. This will include the current and future state of electric vertical takeoff and landing, more commonly known as eVTOL, electric school buses, port de-carbonization projects, and a final session on e-micromobility that you won't want to miss.

In just a little while you'll hear from today's MC and Veloz Strategic Partnership Director Munni Krishna. But for now, let's get right into today's agenda.

It is my absolute pleasure to introduce our keynote speaker, Gabe Klein, who is the executive director of the Joint Office of Energy and Transportation. Gabe's here to share his thoughts on transportation electrification in the United States, his deep background and expertise in mobility, the Joint Offices NEVI program, and of course the brand new $2.5 billion grant program just announced last week. Welcome Gabe, and thank you for being here.

Gabe Klein, Joint Office of Enegy and Transportation: Good morning and thank you to Veloz for the invitation to participate at your Planes, Trains, and Automobiles: Electrifying Everything Summit, which is right up my alley, if it was like planes, trains, automobiles, bikes, scooters, ride hailing... No, I'm just kidding.

I really love the theme of this meeting because we are really talking about electrifying everything. We're talking about reinventing the way we move and really the way we power our economy around renewable energy. And I can't think of a more important mission in the United States worldwide right now than that, to assure that ourselves, our children, our grandchildren, have clean air, great efficient ways to get around, access to mobility and upward mobility at the same time. Our vision here at the Joint Office of Energy and Transportation is to realize that vision, a future where everyone can both ride and drive electric, which I think is very much in line with the theme of this event.

For those of you that don't know me, my name is Gabe Klein and I'm very passionate about ensuring that everyone has access to the clean mobility option that meets their needs. I've spent about, wow, 30 years this year in this space, and I've been in the car sharing industry in the early days. I've worked in bike sharing, I've worked in city and state government, and now in the federal government trying to promote equitable access to safe options, healthy options. And when we think about the space that we're in, it's really about the outcomes, right? It is about equity, it's about wellness, it's about access to opportunity. And I think it's important no matter what role you play in this space, whether you're in a private company, whether you're in a local government agency, in an NGO, in a nonprofit, to always remember those outcomes.

And switching gears to our office, the Joint Office again, many of you may not be familiar with it because we were established with the bipartisan infrastructure law just over a year ago. So we're very new and we've been focused on supporting four federal programs, the National Electric Vehicle Infrastructure Formula Program at USDOT, also known as NEVI, which has $5 billion for states to build a national electric vehicle charging network along the alternative fuel corridors. And there's 75,000 miles of those corridors, and that will be a fast charging network. And you may have just seen last week the announcement that we made with DOT and DOE with both secretaries, the charging and fueling infrastructure discretionary grant program or CFI, and that's $2.5 billion in community and corridor grants, 1.25 billion each pot for EV charging. So this is discretionary grants versus NEVI is a formula program.

And I do want to mention that this also includes hydrogen, natural gas and propane fueling infrastructure. So while we are primarily focused on light duty vehicles, there's also the potential for a medium and heavy duty component. And as we move into the community grants in cities, we very much understand that there's an interest in multimodal transportation, curbside charging, powering fleets like ride hailing and car sharing and car rental and all of that. And we are very supportive of those efforts. There's also the low no emissions grant program for transit. USDOT, FTA, and that's $5.6 billion in support of low and no emission transit bus deployments, and then USCPA's Clean School Bus program, which is another $5 billion. And we understand that first of all, this is a lot of money and that there's a lot of technical assistance and resource needed.

And a lot of what we view our role is to simplify. We do formulate these programs with our partners at DOT, DOE, the White House and so forth. But as the programs go out, our job is to work with our stakeholders, work with all the folks like you to figure out the best configuration of funding, to answer questions about how to apply, to point you in the right direction for subject matter expertise, whether it's within DOE, DOT or another agency. And we want to be in some sense the front door to the federal government, which we understand is very opaque. I've spent years navigating it at the city and state level, and sometimes just having somebody to talk to, to ask where to go. And that may be at a national lab. We work with most of the national labs, we work with Volpe, and there are just incredible resources that are available.

We also do a lot of proactive engagement. So if you go to our website, driveelectric.gov, you'll see we have webinar series. Some are in partnership with Federal Highways, some are in partnership with local governments, and we are working to get people the information that they need to make the application successful for this funding. We also, to serve communities, have recently formed the Just Lab Consortium. We're partnering with three national labs, DOE labs, and this group will share equity best practices and provide technical assistance through analysis, webinars, trainings and reports. And then also we want to mention that to find additional technical expertise, communities can tap into the Department of Energy's Clean City's Coalition Network. You can enter your zip code and find the coalition closest to you. We have other resources on our website, including the Rural EV toolkit. Soon we'll have the Urban EV toolkit as well.

And on our website, you can also look at all the state EV deployment plans. Let's say you're a town, city, regional government. You can look and see what is your state already committed to and asked for in the first year of the NEVI program. And then there will be annual submissions coming in from the states. We're also working on developing a centralized data platform for all of the data flowing from the chargers, as well as other data and insights from public and private feeds. And we encourage you to subscribe to our news alerts on driveelectric.gov so that as we are evolving our program, bringing more resources to bear as we're staffing up dramatically, and we encourage you, if you're interested, to also look at the careers page on our website. But we will be updating with our newsletter with all of the proactive technical assistance and also FAQs, community engagement, cybersecurity, reliability, information workforce and all of that.

So we can take a holistic approach and give you the information to take a holistic approach to envision this future of clean transportation. And whether you're in a urban, suburban, or rural community, you have what you need to be successful and that you have the capability of putting, charging or clean fueling infrastructure in the ground with an eye towards the next 50 years. And we're calling that a dig once approach. So when you're lighting up a curb, let's make sure that you're doing what you need to do for electric bikes, scooters, ride hail, single occupancy vehicles, taxis, and so forth. With that, I think I'm at my time. I really appreciate you having me and I hope the rest of the conference goes well for everybody. Thank you so much.

"PREPARED FOR TAKEOFF? WHAT'S NEXT FOR eVTOL" SPEAKERS

- Clint Harper, C.M.
- George Kivork, Joby Aviation, Head of U.S. State & Local Policy
- Dan O'Shea, ABB, Head of Business Development
- Moderated by Munni Krishna, Veloz, Strategic Partnerships Director

"PREPARED FOR TAKEOFF? WHAT'S NEXT FOR eVTOL" TRANSCRIPT

Munni Krishna, Veloz: Thanks so much, Gabe. We know that you and everyone at the Joint Office had a really busy week with that $2.5 billion announcement, so it certainly means a lot to us that you joined the Summit today.

Hello everyone. As Josh mentioned, my name is Munni Krishna and I'm the Strategic Partnerships Director here at Veloz and your MC for today's event. I'm going to be your summit guide taking you from panel to panel and from giveaway to giveaway. We hear you, that after three years, it's tough to be on multi-hour Zoom webinars. So we're going to deliver crisp short panels and fun prizes to make it worth your while. Reminder that one person who sticks it out to that last panel today is going to be eligible for a $300 gift card, which we're going to announce during the event.

Just some quick housekeeping notes for you. Today's summit is being recorded and will be available after the event along with the transcript. It's a continuous Zoom webinar link, so you can use the same link even if you need to come and go. For each panel, we'll be putting white papers in the chat so you can explore the topic at your leisure. We'll have two panels in the morning, a quick spotlight chat from our community partner, and then two final panels at the end of the summit. But before we get into it, let's get some folks some prizes. We want to know what sector you represent in the EV ecosystem, and every single person that responds in the winning sector is going to get a $5 Visa gift card in their email from Veloz right after the summit. We're going to leave that poll up for a minute while I introduce our first panel, so be sure to select your answer now.

All right, is everybody prepared for takeoff? We are about to dig into what's next for eVTOL during our first panel of today. This discussion was actually thoroughly put together and originally supposed to be moderated by Keith Dickerson, Sales Director over at Black & Veatch, a longtime Veloz member, but unfortunately Keith is out sick today. So the bad news is that you've got more Munni time for the whole audience. But the great news is that we have a stacked panel with some amazing thought leaders. With us today, we've got George Kivork, Head of US State and Local Policy at Joby Aviation. Dan O'Shea, VP of Business Development at ABB, and we've got a subject matter expert here on the line, Clint Harper.

So audience, as we move towards 100% transportation, electrification, urban air mobility is really the next great horizon. Morgan Stanley estimates that the global electric vertical takeoff and landing or eVTOL market will hit $1 trillion by 2030. Manufacturing is already in full swing and FAA airworthiness certifications are right around the corner. To make this sector a reality, it's going to take all of us here in this ecosystem and let's dig into what it's going to take to get eVTOLs in the sky.

But before we get into the meat of today's conversation panel, I was hoping we could take a bit of a step back and talk about the use case for eVTOLS. Are these aircrafts appropriate for short

flights? How far can they go? Do they transport goods? George, tell us what you think about that.

George Kivork, Joby Aviation: Thank you Munni for this excellent conversation and to dive in. Short answer, yes, long answer, I think the individual specifications of each aircraft provide a lot of unlocks here. So for Joby Aviation, we're looking at the aerial ride share market. We're looking to transport four passengers with a pilot up to 150 miles to 200 miles an hour, and looking to go on short distance and legs. Looking at congested cities, areas where trips that would normally should take 20 minutes are taking upwards of an hour, and we're going to come in and do those in eight minutes or so.

So if anyone's ever flown out of downtown LA or out of LAX, getting you from LAX to downtown LA in about eight to 12 minutes. So that's our use case. But at the same time, like I said, the aircraft themselves, you have other manufacturers that are looking at autonomous, you have manufacturers looking at cargo. Our individual aircraft, for example, could be utilized for just individual movement for passenger, for medical response.

There's sort of unlimited as we begin to explore these. And I think as Clint may try to probably speak to this, is making sure these aircraft are used and deployed and accessible in an equitable unlocked manner, I think is unique here as we explore this.

Munni Krishna, Veloz: Great. Actually, Clint, you're up next. Love to hear your thoughts on this.

Clint Harper, C.M.: Yeah, I'm glad George didn't take all my answers, so appreciate that, George. Leave a little bit for me there. So I think when we're talking about eVTOLs, so the electric vertical takeoff and landing aircraft, most of them are following, I guess, a similar use case that Joby is following with moving passengers. I think if you do a quick Google search on AAM and eVTOLs, that's the primary use case that a lot of the manufacturers are targeting. Now, it's not to ignore all the other use cases that are out there and other aircraft. And so when we look at advanced air mobility as a whole, we're not just looking at the electric vertical takeoff and landing aircraft, we're also looking at electric conventional takeoff and landing aircraft, or eCTOLs, electric short takeoff and landing aircraft or eSTOLs and un-crewed aircraft systems, large and small, and hybrid variants of all these aircraft types are also envisioned.

And so when we look at the broad range of aircraft that are under development and on the horizon, we see the utility in the use cases expanding from not just passenger movement, but also to cargo, disaster, response, medical transport, and in a number of other use cases, and some I'm sure still haven't even been thought of yet. But I think the key thing is that when we recognize what aviation is traditionally been used for in the past, it's always been to move high value time critical assets, whether that be people or cargo. And sometimes my unpopular opinion among the industry is that that's really not going to change. Now, I'll caveat that, what it is going to change is the calculus around how we define high value and time critical. And

right now where we look at who has regular access to an urban aircraft, urban charter services within a city is probably someone making close to seven figures or more annually.

So how are these new solutions? How are these new aircraft and all the innovation that's happening within the innovation industry going to start moving that needle to the left so that eventually it's more accessible to say somebody who's making $500,000 a year. That's still a significant amount of money, not accessible to a lot of people, but we're moving the needle, we're making it more democratized.

And that's been a journey that aviation has been on since the 1940s and trying to get aircraft and aviation more accessible to people. And when we look at the big picture of where all this fits in, we've been on this journey for some time. And so advancing your mobility is just the next phase of an evolution within aviation.

And I like to try and anchor it with that so that we don't get focused on all the newness, because sometimes focusing on that newness can complicate the vision and make us wonder, are we thinking about this? Are we thinking about that? And when we anchor it back into aviation, we've been thinking about those things for a long time. Aviation is an incredibly safe mode of travel because we've been thinking about that stuff since the '50s and '60s, and that's been the big focus of aviation. And so we're continuing this evolution to make it safer, to make it more democratized and to expand use cases and utility to more people.

Munni Krishna, Veloz: That's fascinating, Clint. So Dan, we know that you and ABB will charge anything anywhere no matter if its people are good. So stick with us. We'll get back to you soon here. Guys, I find it so inspiring that Billy Nolen, who's the acting administrator of the FAA, recently identified the 2028 Summer Olympics in LA as an opportunity to potentially showcase leadership and eVTOL technology. He actually said, "we're talking about having hundreds if not thousands of advanced air mobility vehicles by the 2028 timeframe."

So let's take a minute to talk about really what it's going to take to get there. And George, that's right around the corner, but your team is well on their way. You just successfully completed the second stage of a five stage process to certify commercial passenger use of the aircraft. Break that down into layman's terms for us. What is that process? What do the next three stages look like?

George Kivork, Joby Aviation: Sure. And to your point, yes, it does seem very far away that this is going to be happening, but I like to remind folks that anytime you have an opportunity to fly up to or be near Marina Municipal Airport up in Monterey Bay, California, you're welcome to come by and you'll likely see our aircraft flying in the sky where we do all of our daily testing of our full scale aircraft. So it is right around the corner and it is happening today. And to your point on the certification basis, I will try to break this down into layman's terms, the way it was broken down to me as a non-engineer. First, we're going to tell the FAA we're going to build

the aircraft, then we're going to build the aircraft, and we're going to show them how we're building the aircraft.

Then we're going to show them how we're going to get that aircraft certified and manufactured. Then we're going to test that aircraft, and then we're going to fly that aircraft once they certify our pilots and process and allow us a certification for commercial service. So a very quick and dirty and very layman way of saying that through the stage four process, which you've articulated in much more eloquence in our investor relations report, we've completed essentially 95% of our stage three process.

So we've got two more stages to go for our stage five certification and which will be completed with essentially what's called a show and verify process, if you will. So what we'd like to do is sort of track both where our submissions are with the FAA and how their response is on approval timeline, they've been incredibly responsive. I think having the acting administrators focus on this and prioritization of this has helped invigorate a lot of the staff and officials within the agencies. I think it will allow us to stay to that timeline of being certified for commercial service operations in 2025. You'll have some of this aircraft, like I said, already in flight for testing and currently operating. And we are in manufacturer of additional aircraft. And again, we are one of many companies looking in this space, but obviously, hopefully the poll leader for now, but it is right around the corner.

Munni Krishna, Veloz: Awesome, George. And Dan, listen, if George is saying it's right around the corner, he's got to build it, we're looking to you and ABB to charge it. So you recently announced a partnership with a German-based eVTOL company called Lilium. Can you tell us a little bit about what this partnership signals to the market as it comes to your overall charging portfolio?

Dan O'Shea, ABB: Sure thing. Yeah, this is true. We have an agreement with Lilium to provide charging services. And while for me doing business development, I get to look as we're doing the future of charging, now I get to look even further down the road and the market signal is that the aviation companies are at a stage where they now need to consider actually how to charge these. Usually, I've been doing this for a long time. Sometimes the charging is actually thought of after the fact and usually not... you don't go out to bid until a lot of stuff is already done. I think some of the lessons learned are start early with your partners. So I think you mentioned something like a trillion dollars by 2030. In the last five years, there's been something like $14 billion invested in electric aviation and so this is the market signal that these companies are now ready to start actualizing their partnerships.

And so they're identifying their stakeholders. We are involved in the continuous development cycle. The good news is that what we need to provide for the electric aviation is not new and fancy and undiscovered. The power levels that we're talking about exist today. So 350 kilowatts

with 500 amp cables is what a lot of the planes and jets, actually Lilium is an electric jet company, that is what they're looking for with an eventual eye to megawatt charging.

And so the important things are that we are in the development cycle, the multi-year development cycle, we're providing the charging services, the power levels are there, megawatt charging is on our roadmap. It's not necessary today. But developing those systems, one of the most important things is staying close to the standard. So in aviation as in with automobiles, there's been the classic debate of what's the charging protocol? Is it Chatham or CCS for the vehicles?

Now there's been some debate on CCS or GBT, one of those should be the standard. I think it looks like it's settling on CCS One, and then when will it turn over to MCS, which is still managed by Charing. So there's continuity in standards and the aviation manufacturers and charging companies like us have been involved in Charing for a long, long time.

So that's super important. And the other standards that will be new to us, but as one final kind of note on this, are the FAA and safety standards and things like you can't just plop a six-foot charger on a helipad. There are going to be a lot of safety issues. Does everything need to be under the ground? Does it need to be off to three meters? Do the cables need to be 40 feet long? Do they want induction charging? Like pilots are not going to be plugging these things in, they need auto charge, plug and charge, things like that. So these are all technologies that are in process for vehicles from the Nissan League to Class 8 Cabs and are now in process for aviation.

Munni Krishna, Veloz: Oh, Dan, that takes me back to our charging days together from 10 years ago. Clint, let's go to you. I mean, the Olympics are in your backyard, my friend. So I'd love to hear from your perspective, talk to us about the policy and regulatory guidance that you think would help ensure that this aerial mode transportation is safe, equitable, and sustainable in the long term, even beyond the 2028 Olympics.

Clint Harper, C.M.: All right, so that's a tall order that we could probably spend a whole day on just talking about what that means. But to kind of simplify and continue to demystify all this, I think it's important to recognize that we have urban aviation today, in operations today, albeit at a lower scale. We have urban aviation infrastructure that exists today. And so I think going back to the basics is, really step one is, understanding what assets do you have in your backyard in any one community. I make an argument that while Los Angeles does have a pretty robust helicopter community with a lot of charter operations that are taking place, another community that I'm familiar with is Salt Lake City, doesn't have that similar level of charter operations, but they have quite a few hospitals that have heliports attached where they're transporting medical goods, emergency patients, and things of that nature.

That's still aviation that's taken place within the urban environment. That infrastructure has still had to go through a development process, a review process. There's a policy that exists to

guide decision makers on how to develop all that infrastructure in a safe way. So anchoring ourselves back to what we have today, then we can look at what is changing in the future and how does policy respond to accommodate for those changes.

So one big change obviously is that we're transitioning from electric motor propulsion systems that are powered by liquid fuels to electricity. And so as a former firefighter, one of the big things that we struggled with is if we responded to an electric vehicle fire on the freeway, what is our tactic? What is our strategy as we respond to that? And in large case, it was we're not likely to put it out with the resources that we have on hand, so let's isolate it, control it, keep it from getting out of hand, and then protect the structures and people around it.

Now, that might be a little bit more difficult to envision when you're looking at if this facility is going to be on top of an occupied building and what that might look like. And so we start to fill in the gaps. What information are we missing today? Are the performance capabilities different that we need to account for?

So when we look at vertiports as infrastructure, we're evolving from heliports. And heliports aren't just the concrete pad or aluminum pad with a big H or a big cross in the center of it. It includes the airspace that surrounds the facility. There's a lot more that goes into heliport and vertiport design than just the physical stuff that we see on the ground.

And so how does that need to evolve into the future? And the FAA is working on that right now to refine a vertiport design guidance that cities can look to as reference on all that. And so, you just keep continuing that down is, what do we know? What are we evolving for? And then finally, to touch on the equitable and sustainable pieces of it, what mistakes, what did we forget about in the past when we developed this infrastructure?

And not just with helicopters and aviation, but all transportation modes. What are the issues on the equity side when we plowed through communities to develop freeway infrastructure? What are the equitability issues when development starts to encroach upon an airport and now the people surrounding that airport have to deal with the negative externalities associated with aviation, but have very little access to the direct benefits of aviation.

So getting those questions out in the open and getting a good discussion around what do the solutions look like? What does our response look like to guide AAM to a new future is where things need to be. And so that just takes a lot of collaboration, a lot of data sharing, and a lot of communications back and forth.

Munni Krishna, Veloz: Yeah, totally agreed, Clint. George, Clint talked about this a little bit, about aviation's been around since the Wright brothers, so people are familiar with this. But when we think about consumer adoption, is it similar to EV adoption measures or totally different since you're asking people to get into aircrafts instead of cars? Talk to us about what that looks like from your side.

George Kivork, Joby Aviation: Sure. What I would say is to Clint's point, agreed. That there are currently 5,800 airports across this country right now. I think there's about 150,000 registered aircraft, of which 10,000 of those I believe are commercial jetliners. So that gives you a context of what we're dealing with in terms of the national airspace looking up above and making sure, are we going to get completely crowded? And looking at what is the current existing infrastructure? And I think to Gabe Klein's point, re-imagining sort of our public spaces. And to Clint's point, currently airports are places that you may not want to live next to. But if you get to the point where you have electric aircraft, we all know are quiet, but that's a starting point. But an aircraft like Joby's, which is coming in at 65 decibels at 500 feet and at about 40, or which is our current level of conversation, by the way, and at 45 decibels in flight, you might see the potential that people may actually want to live next to these things.

It might be an opportunity to say, once these are scaled up and there are multiple companies offering the service, including Joby leading the market, of course, and we have 10 or so aircraft, you've got three or four vertiports sprinkled across the county, and you're doing, let's say LA, and you're doing 300 of flights of these a day. Yes. And you're paying $50 to go eight to ten miles at $4 a mile, you might see a point where folks say, "wow, this is actually at scale, a service that I want to live next to." It eliminated emissions, it's eliminated noise. And now I've re-imagined a space like Van Nuys Airport, or I've re-imagined a space like Fort Lauderdale Helipad or the Miami International Private Heliport to now be a part of a connector network, which is already part of the existing infrastructure. And to Dan's point, there are airports and there is existing infrastructure and there's existing charging. And we need to understand how you incorporate and utilize that before we get to sort of the next phase. So that hopefully that answers the question that you were asking.

Munni Krishna, Veloz: Yeah, it totally does, George, and I'll tell you, it takes no convincing me to get on a eVTOL instead of that hour and a half from San Jose to San Francisco airport. So I'm your first signup, I swear.

George Kivork, Joby Aviation: And in terms of safety, I saw some, I believe... I'm not sure how we're extracting the questions, but in terms of safety, I think that's also what's slightly different. I think there was a sort of panic or an anxiety, or I remember when we were working with the cities in the loss of charging or the loss of capacity. And then you're sort of stranded somewhere. I think you're looking at it now to an aircraft, which we've, as Clint said, been doing since 1950. The certification process is something that's evolved within the FAA. It is not something new that we're sort of creating. It's not, at least for our aircraft and many of the aircraft, urban aircraft mobility, not drone specific, but it is technology or certifications and processes and regulations that have currently been tested in current aviation space and continue to be reformed and perfected. So we will be operating within those parameters, which I think should give folks some comfort and some understanding that this is an existing space, if you will. No pun intended.

Munni Krishna, Veloz: Yeah. Love that. So panel, I think you guys know that the vast majority of Veloz's network, we're in light duty passenger vehicle charging. And when we were coming up with all these topics, it really struck us that, I wonder if there's any investment that's from the EV charging space, whether it's infrastructure or manufacturing that's being translated into the sector that you're working on. So starting with Dan - to the sector that you're working on. Starting with Dan, we're looking at 600 kilowatt charging, right, for eVTOL at minimum. That's thicker cables, higher voltage. We're wondering, can any of ABBs research and development or even manufacturing ramp up to your 350 kilowatt EV charging platform? Did you use any of that as you were looking at what you're charging for Lilium? Or was it brand new?

Dan O'Shea, ABB: At this point, none of it's brand new, which is great news. We have our split systems that we provide mostly for transit, and this is probably the way that it's likely to go. Because the cabinets can be whatever safe distance away or underground that they need to be from the dispensers and like we've done for transit, we can customize the dispenser itself. We at first thought that pantograph, for example, would be on a pole, on a turnaround at a route and yes, we do those installations, but we do way more installations now. Pantographs mounted in a gantry in a depot, so we may have 10, 30, 50 of them in a row when the buses pull in and it's completely automated. This was not something that we had planned, but the transit industry said they started expecting this and this is what they needed, because they weren't going to redesign their depots because of space and real estate and all things like that.

There wasn't space for a big chunky charger in between the buses. At first, we did cables that were hanging down from the ceiling with all the gear on the roof, and we do that, all right. Then we did an electric reel that would come down and now we do pantographs and we do all of the above. We also are taking power modules and power electronics, kind of like computers and computer chips are getting smaller, denser, more powerful as time goes on. So having a 600 kilowatt, one or two cabinets is on the roadmap and this is not going to be brand new. It'll be a new form factor, but it's not anything significantly new that has to be redeveloped.

Again, it's the length of the cable, how it's cooled, is it going to be 500 amps or more? If it's going to be significantly more than that, is there going to be cooling on the airline, on the jet or airplane itself? These are things that have yet to be worked out. Once you get up to megawatt charging, these are the engineering conversations that are happening, but they're within visibility.

Munni Krishna, Veloz: Clint, I think you kind of touched on this a little bit, but when we think about electric vehicle charging, states like California have passed new green build codes saying that all new buildings have got to be at least piped for the possibility of EV charging. I'm wondering from your perspective, is there anything we can do in the planning process for new builds that would help EV tool charging?

Clint Harper, C.M.: Yeah, so I'm going to take a little bit different direction with this.

Munni Krishna, Veloz: Yeah, absolutely.

Clint Harper, C.M.: I want to start with, when I used to teach aviation facility design for the military, we really tried to communicate that we don't build airports, teleports and uncrewed facilities for the perfect day of operations. We build and plan these facilities for when things go wrong, so that we have a safety margin to build around. So if an aircraft departs a runway in an emergency, when it departs the runway, we maximize the chances of survivability of the aircraft and the people on board. We'll keep that in the back of our head for the meantime. Now, I've had a number of conversations with different power providers across many different jurisdictions, and when I initially ask, can we include eVTOL charging capabilities in the range of what was talked about earlier by Dan, is 350 kilowatts even to a megawatt, megawatt and a half? Always get the engineering response first, which is, "Of course we can do it. It's just how much money do you want to spend and what is the feasibility of doing it? What is the viability of doing it in any one location?"

To answer those questions around feasibility, we need to know, or that power companies need to have an idea of where this infrastructure is going to be located at, because that's going to inform follow on work or periphery work it's going to have to be done in conjunction with that. If I wanted to put a vertiport smack dab in the middle of a downtown area in a destination-rich environment, that building or that block might be nearing capacity from its substation. In an upgrade, could also include an upgrade to the infrastructure that's feeding that block and if it's in a downtown environment, a lot of time that infrastructure goes underground.

And so what was maybe envisioned as tens of thousands of dollars of upgrades to bring power to that site, could easily turn into hundreds of millions of dollars if you're tearing up roadways or even closing down city streets and things of that nature. So having an idea around where does it make sense to have this kind of infrastructure for the charging and the vertiport facilities and that really needs to be a discussion that's had very closely with the industry. Of course, they have an idea of where customers are going to be at, where the existing demand exists, and cities who also have an idea of where are the pain points in terms of equity, sustainability and energy supply you're going to be and within there there's intersecting circles that then start making a lot of sense for, what is this going to look like?

But again, it goes back to that communication, that collaboration being open, sharing data with cities so they understand the full perspective of what's going on with all this. Then to get back to the safety case is, we're busting this downtown infrastructure for eVTOLs or any kind of electric facilities. Are we planning for when things aren't the typical day for when things go wrong? So how well is the fire department, the local fire station equipped to respond to an eVTOL emergency that's maybe taking place on top of an occupied building? How well are they going to be able to protect that building and its occupants? Will the building have to be

evacuated? Does the fire department, the city have the resources to manage that kind of incident?

And if not, in a dynamic environment, if they do on a good day, what happens when the department's called out to a massive wreck on the freeway and now the resources are depleted because they're responding to that wreck now? So what needs to happen after that? And so I want to make sure that we're looking at this through the perspective of a safety lens also, is we're having these discussions.

Munni Krishna, Veloz: I think that's really important to bring up, Clint. Solving for safety doesn't mean that it's unsafe, it just means that we have a plan and that's really important as it comes to all modes of transportation. George, listen, when we're talking about leveraging the EV sector, internet research made us find out that you actually have a Tesla veteran leading your battery pack, design engineering, and it looks like initially you're even going to use automotive cells in production. When it comes to charging, George, are you looking at battery swapping, grid tide, a combination? Can you not reveal that because it's secret sauce, what's going on?

George Kivork, Joby Aviation: What I will say is, in terms of yes, I'm going to try to speak as eloquently as I can as the policy guy when it comes to the engineers and translate and I will probably offend them very much. Yes, we have unique proprietary info of our battery technology. We're manufacturing them in-house. We source obviously, the fuel cell supply, but then putting together the individual motors, the dual redundant motors with the battery packs. The dual redundant battery packs for each motor is all done in-house and the concept in operations would be, the aircraft would land, folks would be able to get on and off and no more than eight to 10 minutes. In that time you're charging up. Much like your cell phone, the idea would be to keep it up to capacity. You're never down for a long period of time and just juicing up, if you will and then the flight takes off for another 15 or 20 minute leg.

Makes its return wherever it lands, charges up again for another eight to 10 minutes as folks are getting on and off. That's kind of the operational tempo that we're looking at when it comes in terms of charging can have. In terms of capacity, we are looking, it will require, I think a lot of numbers have been thrown out for our aircraft, 480 volt, three phase power. That's 60 hertz to supply the ground support equipment, which will have its cooling station, et cetera, and that's worked in within our space and parameters. Which are well within the current, I think as Clint was saying, the FAA guidance for how vertiports could be designed as well, et cetera.

I think, and to Dan's point, the focus for us when it comes to the technology, I think we're looking at the, I think questions we're amazed about the fire and how cities prepare and how cities respond and how do you deal with that charging and what does that infrastructure. I think, there currently exist airports, and this is why we've put in the effort in making sure the federal governments pass the advanced aerial mobility infrastructure grant program. To provide airports the ability to look and study as to how they can expand their current exit

infrastructure, electrify that infrastructure, draw the line if you will, as you say, and then enable the industry to figure out how it's going to plug in on the backend as we work through our individual capacities and our various aircraft.

Munni Krishna, Veloz: Wow, that's really interesting, George. Dan, I'm going to pick on not only your experience at ABB, but your past life, at ChargePoint as well, which saw you working really with customers to install DC fast charging sites all over the country and the world really. And that's very similar to eVTOL vertiports, because we were putting power into existing buildings and the difference obviously, is we're talking about skyscrapers and stuff. So talk to us a little bit about, is there anything you think we can learn from the past five, 10 years of drop in DC fast charging sites into the ground and how we can work to tackle the problem for eVTOLs?

Dan O'Shea, ABB: Sure thing. I do want to go back to one of the comments about George mentioned-

Munni Krishna, Veloz: Let's do it.

Dan O'Shea, ABB: How long does it take to charge, basically? That's always the question. How long and how much power and I want the fastest. What's comforting to me is, it's the same question, whether it's a seven kilowatt charger or a megawatt charger, how long are you parked, right? That's basically the equation you have to start with. How big is your battery pack, what's the voltage, what amperage can you take and how long are you parked there? And it may be that it's an eight to 10 minute charge during your business cycle and then you've got an overnight depot and it's going to be different for everyone. So that calculus is embedded in what we do every day. So this is actually really, really good news. We can apply this to the use cases of the variety of electric aviation.

I find this interesting and comforting, is that the same questions apply, how far are you from the transformer? Does the utility have the hosting capacity? Can you get service? Can you get an interconnection? The availability of transformers and service interconnections is the topic of the day when it comes to charging the old-fashioned four wheel drive electric vehicles, the ones that go on land. This is still a big topic and it's not insignificant. Some of the good news is that ports all over the world, all over the United States are already working on electrification plans and eVTOL have been on their radar, so to speak, no pun intended. I think that they're probably doing some capacity planning around it. When you're talking about skyscrapers and things like that, Clint already mentioned, you've got your service center's going to be underground if your heliports on the roof.

I mean yes, you're going to run a long conduit and you're going to run a lot of power up there. You have to have bring that into consideration. Another thing is, I've seen in some of the plans, the helipads either on a pier on the water or on flatland by a river or things like that. We've actually been working on projects that are in newly designed storm surge areas. This is the

effects of climate change that we're experiencing today. Now you can no longer put these new service interest in this gear at the sea level or in the flood zone, and so we've actually got dense urban areas where they're needing to put the gear on the third floor of an existing structure that requires retrofits to have this heavy gear in this building. So there are a lot of new considerations that have to be taken into account.

I would say that utility engagement is critical and understanding the hosting capacity and using energy management. I mean, these are the fleet topics, these are still all the things, whether it's light duty fleet or class A trucks. It's the fleet calculus of how many plugs do you need to be working at a time? What's your maximum capacity? Can you manage the load to each plug as it's needed, as it's coming in for those every eight to 10 minutes? So you might not need 5,000 amps. You might only need 3000 amps, as long as you intelligently manage it. So to the comfort that we can take is that this calculus already exists for fleets, all right, but it needs to be changed for the use case here.

The other thing that's happening is circuits that are maxed, feeders that are maxed in utility and there are a lot of conversations in the fleet space about distributed generation, battery energy storage and avoiding demand charges, but also really putting something in, that might be say, quasi mobile. Where you have a four to five year wait for this circuit to be upgraded and you can have your generation and your storage there and you can operate until that circuit gets there and then you can perhaps move it or keep it there for redundancy. These are also our fleet topics that are being discussed today that I think can be applied to these kinds of unique sites.

Munni Krishna, Veloz: Yeah, let's pick on that a little bit. If I'm hearing you correctly, eVTOLs are a bit analogous to a bus fleet. So you've got overnight depot charging and then you're talking about charging them up for their specific routes. You might not have to charge them all the way, because maybe they're just going a short distance. Is that what you're thinking?

Dan O'Shea, ABB: Well, for the depot, if there is a depot situation where the asset is parked for a period of time, you can use a lower power charge and charge it over a longer period of time. You also aren't going to want to, I'm sure there's going to be a safety benchmark at state of charge, whether your eVTOL is never going to go below 30% or whatever that safety margin is going to be. It's probably marked at a point. It's also actually good for the battery to not discharge and charge up and down past the 20% to 80%. So the longevity of the battery is important there too, but it is a lot like the calculations or a fleet or for a multi-use public trucks stop or rest area, where you might have light duty vehicles on one side, heavy duty vehicles on the other side. Those heavy duty vehicles are going to need to come in, because the drivers literally by law, have to rest for a certain amount of time and then they can drive again.

So those rules about the human component of it. Now where you don't have a human, you don't have that limitation, so that allows for a different calculation. But I do think, based on what I'm hearing from George and from Clint and from others in the space, it really isn't that much different. The difference is the FAA regulations on safety on the site and the design of the site and making sure that if you're using a plug-in charge or whatever system you're using, that it complies with the safety regulations. I think cybersecurity and software cybersecurity is going to be a paramount importance obviously, when it comes to anything connected to aviation. So that's going to be something to consider, but it is does seem to me to be fairly analogous.

Munni Krishna, Veloz: Awesome, Dan. All right, Clint, this final question for the panels for you, it's sort of a big one and I'm only giving you two minutes, so forgive me here, but transportation revolutions are tough. We got to be honest about that, right? Going from horse and buggy to internal combustion engine probably wasn't as smooth as we think it is and in this era of revolutionary new electrified transportation modes, whether it's ride share or micro mobility, we really have seen chaos at times, in that early adoption period as cities figured out regulations. I was hoping to hear from your perspective, what lessons do you think we can learn from that, that we can apply to urban air mobility?

Clint Harper, C.M.: Yeah, generally speaking, in the airport industry there's a saying that airport operators love to use is, if you've seen one airport, then you've seen one airport and they say that tongue in cheek, to have a little bit of fun. But the same applies for cities. The cities that I've talked to, Dallas and Miami, look at things and handle things differently than Chicago and Salt Lake City who looks at things and handles things differently than Los Angeles and Long Beach. Every city has their nuances of what their sensitivities are, what lessons have they learned in the past, what are the recent pain points that they're trying to avoid and apply in the future. That can make for a bit of a chaotic scene. I think first and foremost is communications and collaborations. You got to be open in talking with the cities. The cities have learned lessons, fool me once with the ride sharing and using the public right of way on ride sharing to make money and not really sharing with cities on how differently the right of ways are being used to influence their planning.

And then shame on you, but shame on me again, when electric scooters just kind of invaded public right of ways back in 2017. So cities are now adapting and they're realizing that ride sharing and electric scooters weren't the only mobility revolution that they're going to have to deal with in the future. And so, they're gearing gear up to respond and that communications recognizing that they're going to have to start breaking out of their silos to be inclusive of other areas such as fray aviation and all this stuff, to really look at the transportation system holistically, to figure out what problems within a city is advanced air mobility actually going to solve. Early on, they talked a lot about congestion and I think we've kind of beat the horse and

realized now that an aircraft that can carry four to five people, maybe in early days, can land four to five times an hour at a facility, probably isn't going to do much to combat congestion.

So now the question becomes for who? And so, that opens up to a lot more use cases. What are the two pain points that cities experience in the day-to-day within their transportation systems? What are the real risks of being delayed or stuck in traffic for an hour and a half? What isn't being done that's impacting the community as a whole? And a lot of times that comes to disaster resiliency, medical transport and things of that nature. So then how do we consider that while we're considering passenger movement or mid mile last mile freight package delivery, things of that nature? We want to be collaborating, we want to be communicating, and we got to realize that AM stakeholders within a city spans many different departments to include electric officials, community members, and community organizations. Everybody again, is now keen to all the different revolutions that are going on within transportation and want to be informed and want to be a part of the solution and want to be consulted at least, while we're looking at what the future transportation system is going to look like.

And so we just want to recognize across the board, that this is new and because it's new, to an extent, we have to be communicating very regularly and we have to have that open line, two way back and forth of, "Hey, we have an idea that's going to solve congestion." "Oh well, probably not going to solve congestion, but we have other problems that you can solve." "Okay, let's adjust for that and at the same time we can still make some money by moving some people around." I think we're starting to get to that point where these conversations are starting to become more nuanced and more dynamic in answering a broad range of questions.

Munni Krishna, Veloz: Awesome. Thanks, Clint. Guys, I think that's a perfect place to leave it. I'm sure you've got a bunch of Zoom meetings that now I can let you go to, but I'll have you go off camera, on mute and let you enjoy the rest of the summit. Thanks so much.

Dan O'Shea, ABB: All right, thanks very much.

"PRECIOUS CARGO: ELECTRIFYING AMERICA'S SCHOOL BUSES" SPEAKERS

- Nate Baguio, The Lion Electric Co. Senior Vice President of Commercial Development – USA
- Lynn Ames, Nuvve, Vice President of Partnerships
- Carolina Chacon, Alliance for Electric School Buses, Coalition Manager
- Gilbert Blue Feather Rosas, Modesto City Schools Maintenance & Operations Director II – Sustainability & Adaptation

"PRECIOUS CARGO: ELECTRIFYING AMERICA'S SCHOOL BUSES" TRANSCRIPT

Munni Krishna, Veloz: Of course. Audience, I know y'all are waiting for the results of our sector poll. Good news here, for any of you that were in other EV groups, nonprofit, advocacy, social justice, environmental justice or research, all 47 of you are getting a $5 gift card from Veloz at the end of this summit. So whether it's a cup of coffee or a glass of cheapish wine, cheers to you. But on that note, let's get right to our next panel, "Precious Cargo: Electrifying America's School Buses." This one is thankfully not being moderated by me, but instead by a true subject matter expert, Sue Gander, the Director of the Electric School Bus Initiative at the World Resources Institute, an organization that's been represented for many years on the Veloz board. She is joined by Nate Baguio, Senior Vice President of Commercial Development at Lion Electric; Lynn Ames, VP of Partnership at Nuvve; Carolina Chacon, Coalition Manager for the Alliance for Electric School Buses; and Gilbert Blue Feather Rosas, here to talk about his work both at the Modesto and Stockton City school districts. Sue, I'll let you take it away.

Sue Gander, World Resources Institute: Great, thank you, Munni. Great to be with you all today. Just really excited to have this conversation. I'll just start off by sharing with folks a little bit more about this precious cargo that we're going to talk about. America has over 480,000 school buses. They transport about 20 million kids to school every year, and in doing so, they serve as the largest form of public transportation that we have on the roads today. The concern here we're going to talk about is that currently, more than 90% of those buses run on diesel. Diesel is a known carcinogen. It's bad for students and drivers health and also for the planet, but the good news is there's over $5 billion being invested by the US Environmental Protection Agency through federal infrastructure rules and over the next five years, they're going to help electrify the school bus trips that kids are taking across the country.

On top of that, we've got billions of dollars in additional investments being made by states and utilities, so we have a great opportunity to address what is really an urgent issue for us. Our team at the World Resources Institute is working via our electric school bus initiative and partners nationwide on the effort to equitably electrify the entire school bus fleet and you're going to hear from a lot of folks doing just that in just a moment. Just thrilled to have this expert panel with us today, really help us figure out how do we get from where we are now. Which is, on the order of hundreds of electric school buses on the road, and how do we get that cleaner and healthier ride for all kids. With that, I'm going to jump to kind of a lightning round, I guess, with each of the four panelists here.

We'd love to hear a little bit more about what is happening already, what's going on, what projects are actually happening now on the ground, and what are some of those lessons learned that everyone can share. I'm going to start with Nate from Lion Electric. We just heard that there's 19 Lion Electric school buses are going to be coming soon to East Baton Rouge Parish school system, Louisiana. Then we also heard about 25 of your buses were awarded in Atlanta, Georgia. Tell us about how did these projects come to be? What are some of the

values that those buses bring and what role do you think more broadly OEMs have in helping to secure some of this funding?

Nate Baguio, The Lion Electric Co.: Hi, Sue. Good to see you again and Veloz, thanks for having me on this panel. Greetings. Looking forward to this discussion. You know mentioned East Baton Rouge and Atlanta Public Schools. We have buses going to Oklahoma. There are hundreds of buses that are going to be deployed as a result just of the EPA program that you mentioned. There are buses being deployed in many other states from Illinois, and I think what's exciting about that is it's not just a California thing, this is nationwide. The economic argument for the electric school bus is making this possible for school districts and make no mistake, this is inevitable. This is happening. I started in the school bus industry over 30 years ago and have seen the different changes happening and this one is monumental, historic and exciting, and we're seeing that with a response across the country.

The role that OEMs and this industry in general can play, is really communicating that culture change. When you look at the electric yellow school bus from the standpoint of the day-to-day operation, the driver getting in the bus, picking up kids, taking them to school, it's the same. The buses perform. They've been on the road since 2016. There's data available, not only from us, but from WRI as you know, on the performance of these vehicles. The exciting part is that all the benefits you get from them, the reduced cost and helping districts understand total cost of ownership, rather than year to year expense on sticker price. The money that can be allocated to resolve the driver shortage crisis that's happening in the United States now, you can put money back into the classroom because these vehicles operate at such a lower cost and it also opens up other opportunities for vehicle to grid. And this is moving quickly, Sue. Again, this culture change is happening fast.

During the same year that this EPA program was announced, launched, and then awarded, buses were delivered the same year that this was announced. A federal government grant where kids are getting in healthy breathing buses the same year it was announced, which is unheard of and if that's not an indicator of how serious and how real this is, I don't know what to tell you, but this is happening. It's inevitable and it's exciting and it's good for kids and good for school districts.

Sue Gander, World Resources Institute: Awesome and love that enthusiasm. We're really thrilled to see all the progress that's being made. Let's turn to Lynn at Nuvve, to continue the conversation. Talk a little bit more about the infrastructure side. We know that some of the challenges to these electrification projects are ongoing operational costs, and so Nuvve comes in, plays this role as an aggregator, working on vehicle to grid integration and really helping bring some other aspects to these projects and making them successful. You recently received, I think it's $24 million in funding for bidirectional chargers, site design and development services. Maybe tell us a little bit more about the projects you're working on, how you see your

role in the project lifecycle and maybe, what does Nuvve think about this model, your model, and how much it can be replicated.

Lynn Ames, Nuvve: Yeah, thanks Sue. We're excited to be here today. First of all, Nuvve is the global vehicle to grid technology leader, so I couldn't agree more with Nate. We've been doing this for a long time as a V2G aggregator across multiple markets in Europe and Asia, and now here in the US more focused on school bus market. Really what we do is, we reduce the cost of fleet electrification by creating recurring revenue from valuable grid services through our intelligent cloud-based software platform. That could be behind the meter services, demand response or more complex services like frequency regulation. Nuvve software is the most flexible, reliable, and widely deployed software supporting V2G and other grid services for fleets. Here in North America we've been heavily focused on the medium heavy duty market and in particular school buses where we were happy to secure $24 million in EPA grants for schools in the first round and right now we're really gearing up for round two.

Nuvve partners with schools to provide everything they need to electrify their school bus fleets and really guide them through the process. So our team and our role will focus on identifying the current fleet needs, also anticipating future growth capacity, will analyze operational requirements, develop route analysis. We'll really walk the school through the EPA funding, and also look for add additional funding opportunities. We do see additional funding coming from IRA, also utility programs, state programs, local programs, and so we really focus with our grant and funding team on finding all of those opportunities to help the school out. We'll help with charging station selection based on the school's needs, work closely with the school bus OEM or the dealer to ensure a smooth deployment. We also work closely with the utility, and this is a lot of where newbie's expertise comes to play.

We can really help the school walk through the interconnection process, which as we all know can be difficult. We'll help them through installation, construction timelines, help them understand whose responsibility is what, who pays for what and how it all comes together. We also have a customer experience team and service team that will ensure long-term support for the customer. We've definitely learned a lot through the last decade of deploying V2G in the last couple of years, deploying with school districts, and really have the ability to take that entire process and make it simple for the school district and that's where we see a lot of success. I think this is all new and confusing and coming very quickly as Nate outlined and so it's important for partners like us to really take the school's hand and walk them through that process, so that they can electrify. So they can have cleaner school buses for their school, for the children, for the community, and really for the earth.

Sue Gander, World Resources Institute: Yeah, that's fantastic. Great to have this part of the whole school ask equation being paid attention to. Want to move to someone working with the schools themselves. Gil, it's great to see you. You've done some amazing work. In particular,

I'm thinking of how you got funding built and implemented a pretty massive bus electrification program in Stockton all during the heart of the pandemic. And love to hear from you how that all came together, considering that the utility workers couldn't even leave their homes at times. What is the pathway that you built, particularly build the buy-in from the right stakeholders, maybe a little bit more on how you got the funding together, because that's always a challenge, kind of stacking that funding and maybe give us a sense of what were those big challenges and maybe even some of the, I guess, easy wins that you got when putting those buses together. I know it's a lot to sum up, but love to hear that from that success story.

Gilbert Blue Feather Rosas, Modesto City Schools: Thanks, Sue. I'm really glad to be here and represent Modesto and talk about the two different things that I've done. I've project managed two of the fastest deployments in history, I guess for school districts. At Stockton Unified and both of these projects have been in under a year, and Stockton Unified, that was 2020 to 2021, like you were saying, in the middle of pandemic, and then I have recently started Modesto City School since March 13th of last year. At Stockton, I had to get inventive and make them realize that even though they were distancing and social distancing, now is the perfect time to come look at our yard. It was the middle of the pandemic and they could stay 600 feet away from each other. They just needed to make sure that the plans were good and we could start construction. You asked about support.

Battery electric school bus support can come from a variety of sources and many different champions. At Modesto, our board members were the ones that were driving this change. They approved, along with the leadership from Dr. Noguchi, 30 buses, converting half the fleet in one purchase. So that's not just dipping your toe in on a lot of these things. That really is committing to half of your diesel buses. Our funding at Modesto City schools has come from a variety of sources. We had some money for our general fund that was for bus replacement dollars. San Joaquin Valley Air Pollution Control District had a grants for zero emission infrastructure.

And then California Air Resources Board, the hybrid and zero emission truck and bus incentive voucher, HVIP, as well as EPA. We received eight buses through this first round of funding and we were able to stack that money with the HVIP voucher so that it paid pretty much 100% for it. So all of you are right, that now is the right time and the right idea and an amazing amount of funding, but we are spinning plates. There's a lot of stuff going on that's very complicated to consider and I just want to encourage school districts. Sometimes they don't have a sustainability director, but you really can rely on experts like NUVVE and Lion Electric and all the manufacturers and all these different people to help be your resources to get these things done.

Sue Gander, World Resources Institute: Fantastic. And I think those are some of the very buses behind you there in that photo.

Gilbert Blue Feather Rosas, Modesto City Schools: The funny thing about that, Sue, is we actually built this yard, took down light poles June 1st. August 1st, this solar panel was up there and done in two months. So our team really got it going and done and with supply chain issues, we had everything stacked in the warehouse ready to go.

Sue Gander, World Resources Institute: That's so amazing. All right. Let's bring Carolina in on this conversation from the Alliance for Electric School Buses. Such an important coalition there that's working for students, thinking about, in particular, students from low income communities and communities of color who disproportionately ride these diesel buses that we were concerned about. And while we know that electric school buses can really offer a great solution, there's also concerns that we could be deepening some of those inequalities if this rollout doesn't happen in the right way. So love to hear from you around the strategies that you're looking at. How do we ensure that no child is left behind, but really, the underserved children are really brought into this transition that we're so excited about?

Carolina Chacon, Alliance for Electric School Buses: Thank you, Sue, and thank you so much for the question and for the opportunity to be here. Great to be with all of you. This is really important. I'll try to summarize this in the limited time that I know that we have, but getting this right is critical to how this transition will play out and who gets to benefit from it, and the first thing that the Alliance for Electric School Buses is doing is really advocating for any funding program, whether it's at the federal or the state levels, whether it's through a utility or even a public-private partnership, to prioritize funding for the communities that are most impacted by diesel pollution, which data has shown us are low income communities, Black, indigenous, Latinx, and AAPI communities.

And that really means creating programs that are targeted to those communities and considering criteria like income, race, air quality data, public health data, asthma rates, so that you're really targeting the funding to go where it will do the most benefit, and it also means that you need to be able to consult with those communities and talk to them about how to reach them, how to be able to really engage them throughout this process because in order for it to really benefit them, they also have to be involved throughout. One thing that we're doing is really pushing for the EPA as they work on the Clean School Bus Program to continue to iterate and improve the criteria that they're using for prioritization.

So that the school districts that end up on that priority list, again, are those that are most impacted by diesel pollution because we want to make sure that those that are most disadvantaged are prioritized and that's the critical thing across the board for any successful deployment. We also need to look at eligibility criteria. Who gets to benefit from each program? Who can apply? Who gets excluded? We've seen that if these criteria aren't really properly targeted, you can have school districts that are locked out that really merit being there. We've seen that problem with the Clean School Bus Program in that school districts that

may not currently own their fleet and want to transition to ownership of their fleet aren't really eligible to apply.

They have to apply through a contractor and that causes problems because any school district that isn't eligible to apply for the funding directly means that they can't receive the benefits of electric school buses, and that's a huge disadvantage in terms of cost savings for maintenance and fuel, the reduced pollution for students and drivers, obviously, the reduced noise, which is something that folks have been really excited about, and also just a healthier environment. A couple other things for these programs to be equitable, we really need to advocate for disadvantaged school districts to have the support that they need in applying. That means that because they're already limited in capacity and staffing and resources.

And nine times out of 10, if we're realistic, school bus electrification really isn't a priority for them. They have so many other more urgent needs. They really need the support from community members, from government agencies to have that dedicated technical assistance so that they can even apply, and also we need to be able to make sure that as these funding programs move through, they're building relationships with the communities that they're aiming to serve so that there's trust involved, so that community can be a part of problem solving and that they can be a part of decision making. One other thing is we also need materials that are educational to really reach communities and be accessible to them so that they're aware of all the benefits that they're receiving.

And especially if it involves public funding, and again, for us, for our alliance, for our coalition, we are advocates. We're all not-for-profit organizations that are really focused on equity, and for us, those advocacy strategies look like meeting with the EPA and their regional offices, talking with lawmakers, school boards, school districts, talking with really decision makers across the board, but most of all, including community members and community leaders in being part of this transition and listening to what they need and trying to communicate that to the folks that are ultimately designing and deploying these programs.

Sue Gander, World Resources Institute: Excellent. So well said. Thank you. And all of that engagement work, so critical. Just really appreciate all the work that you're doing, the alliance is doing. So that was our lightning round. We're going to now talk about the two big pieces of deployment. First is that initial capital expenditure and getting the buses purchased and ready to go, and then there's that ongoing operation and maintenance.

And going to explore a little bit with some of the folks we have here, those two pieces. So going to start back with Gil this time and talk a little bit more on the infrastructure side. Bringing in these buses can mean for quite an increase in the load required for the charging, and just curious about how you went about that and any additional ways that you were able to leverage what you were doing to also provide support for the remainder of the school system. Just give us a little more of the insights onto the infrastructure question.

Gilbert Blue Feather Rosas, Modesto City Schools: Sure, thank you. The one thing I want to let school districts know is that it is a higher upfront cost, but again, the maintenance costs are lower. So what you're doing is averaging that out, and we based it on the cost per mile over the life of these buses and you realize that as fuel prices go up, that it looks better every time you look at it for the lower costs. So it really is about just financing, leveraging what your costs are. We looked at all the different things from the utility district. We got them involved early and our design team also looked at what were the baseline utility consumption for our years and what was the new load going to be, and we actually even included conduit for future installations on this.

So we made sure that the transformers were sized properly, we made sure we had enough chargers for our fleet as we were doing almost half in one shot, but then we also made sure that we added solar panels as well. Those are the solar panels that went up, and again, if that would cover at least half of our load, then you would be offsetting cost and when, like I said, diesel prices go up, it's way more cost-effective to use electricity for this. We also phased out, in looking at it with the team, three prongs of infrastructure. So we have the chargers that we're putting in, we had conduits put in for future chargers, that way, we could add them later, and then on the south side of our transportation yard, we're looking at adding some more DC fast charging for that capability as well as white fleet.

So as far as looking at the overall cost, it is cost-effective to go with solar and with the battery buses and it is just a way of figuring out what funding mechanisms are out there to be able to get it for you. So I just want to encourage people that it does pencil out, and then to Carolina's point, I just want to reiterate that they're doing great work along with WRI, and both Stockton and Modesto are 82% disadvantaged communities where people are under the poverty level. So I felt a real personal alliance to them of definitely making sure we're making good stewards of this money, and so we are making a difference in the lives and so when half the emissions of your 62 buses, 30 of them are now battery electric come the following school year, that's quite an accomplishment for a year and a half.

Sue Gander, World Resources Institute: Fantastic. I love that. Love the concept of future proofing. This is the future. Let's start planning for it. Nate, how do you approach this with your customers, addressing the upfront cost of the vehicles? I think there's some new developments you have with the Lion Capital Solutions and financing. Just love to hear a little bit more about that.

Nate Baguio, The Lion Electric Co.: Yeah. As the Lion Electric got the first modern lithium ion school bus delivered when this all began, started this revolution of reimagining the school bus, and we quickly learned that it wasn't about designing, building, and selling a bus to folks like Gilbert. We had to help with applying for grants. These are expensive buses and at the scale we're at now, they're going to be expensive for a little while longer, but as we ramp up, that

cost parity even at sticker price is coming, folks. So I want everybody to know that, but school districts fleets, there are a lot of grants out there, stackable grants. It's complicated. So early on, we had to realize that we had to help school districts navigate this complicated grant capture process.

And there's a lot of great ones out there and they're different. Some focus, as Lynn will tell you, on charging infrastructure somewhere on the vehicle themselves. There's a great program that we're participating in that actually Gil pioneered, the clean mobility in schools that connects all the clean technology together with your vehicles, but also working with your utility. There's make ready programs coming up that will add funding to this formula for you that it makes sense from a capital perspective to go electric right now, and these grants won't always be there so now is the time to act. There's an exciting bill in California moving forward that is going to open up lease term opportunities for school districts where you can extend the lease agreement beyond what is currently allowed so that the high cost of the school bus.

It not only accounts for what it costs you on a monthly or annual basis, but also an accurate residual, which is going to be much higher. There'd be much higher book value of an electric school bus than there is of a diesel school bus that you sell to a scrapyard at end of its useful life, and to answer your question, Sue, Lion Capital Solutions is working to reimagine how these vehicles are financed for school districts and other fleets so that it fits the current model. There's no accounting for major component failure, engine replacements, all these things that go away when you're looking at an electric school bus. So the lenders and the financial markets are making this shift quickly and Lion has helped doing that.

Sue Gander, World Resources Institute: Fantastic. Could I try to sneak in two more questions because I want to hear from Lynn and then also from Carolina again, just mindful of the time here? So Lynn, you've got a really exciting project going on with Cajon Valley School District and San Diego Gas Electric involving really innovative partnerships, V2G applications. Love to hear just a little bit about that and your experience there.

Lynn Ames, Nuvve: Yeah. So first of all, at NUVVE, what we've found is that the partner ecosystem is really important and that's part of the success of all our deployments globally. So NUVVE is actually agnostic to the electric vehicles that we work with. We work with school bus OEMs, other fleet operators, light duty, heavy duty. In this particular deployment, we did work with Nate and the Lion team and have Lion buses there deployed with our 60 kilowatt bidirectional CCS chargers. This project actually started as a pilot two years ago along with SDG&E where we had six of those 60 kilowatt chargers and now we're actually up to 14 bidirectional 60 kilowatts that are V2G capable at that one site.

The really exciting thing about this site and also about so many of NUVVE sites across the world is that we're actually doing vehicle to grid. So this particular site, we're participating in something called ELRP, or Emergency Load Reduction Program where here in California near

three IOU territories, you can actually inject energy back into the grid when called upon by the utility during the months of May through October and get paid a revenue generation for that capacity, which you share that revenue with the school district. So now you're actually reducing the TCO in addition to all the funding that everybody else is talking about.

So this is real vehicle to grid that is here today, and I think that's a big message that we really want to hit home. We have ELRP across California. You have another program called DSGS in the co-op and municipality areas in California. We have Connected Solutions, which is a program on the East Coast, which pays around $300 per kilowatt summer. We have other programs being rolled out in other states, and so NUVVE has actual deployments that are here now with bidirectional chargers, V2G software, vehicles rolling off the line, V2G capability, and now you have revenue generation opportunities here in the US and we're doing it now and we're doing it today. So again, I would also urge school districts and other interested parties to reach out to those of us here on the phone who have been doing this for a long time and can really walk you through that process.

Sue Gander, World Resources Institute: Fantastic. We've been talking about all these things that are happening and the workforce is really key part of this. You need the people that are helping make this happen. So Carolina, I'd love to hear from you about workforce development, the opportunities, thinking about the equity question as well, what are some of the things that you're seeing or hoping for?

Carolina Chacon, Alliance for Electric School Buses: Thanks, Sue. In terms of workforce development, we know that it's critically important to make sure that school bus drivers and mechanics have the training that they need to safely and smoothly deploy electric school buses, and that's something that we all need to work on, OEMs, dealers, governments, advocates. We want to ensure that there's adequate training and that it's easily accessible and available. We also encourage school districts that receive public funding to conduct workforce impact assessments so that they can plan for how they're going to retain their workers, provide the necessary training, and maintain good wages and benefits because we know that we want our own workers protected in this transition.

In terms of manufacturing the buses themselves, we believe that this transition to electric school buses can lead to good, well-paying US jobs that have the kinds of benefits that can sustain families and can really ensure that this is an equitable transition that's good for workers, and so what we are hoping to see is that as we see new entrants into the marketplace, that they're looking out for workers and especially for workers that have been traditionally excluded or underrepresented in the manufacturing industry, workers that might have experienced barriers to employment before, or workers that have been displaced by school bus electrification. The amount of funding that the EPA is pouring into electric school buses right now is market changing.

And so we're pushing EPA to also make sure that they're adopting elements of the US jobs plan so that they can get commitments from manufacturers on how they're going to create or protect US jobs and how they're going to equitably hire and promote workers within their industry. We are also encouraging school districts to really considering manufacturing job quality of the companies that they contract with when they're evaluating bids so that we can ensure, again, that this is a good transition for the workers across the board, and the last point that I want to make is that manufacturers, particularly those that are all in on electric, we are counting on you to be great partners in this transition. We're excited to work with you and we really want to make sure that we can build a high road supply chain that benefits workers and communities and makes this transition a really equitable one.

Sue Gander, World Resources Institute: Fantastic. All right. We are moving into a final lightning round, zap, fast, fast. I'm just going to say it's been great talking with all of you. Have got a quick question for each of you to try to answer very briefly, and I'm going to give the question now so that we can quickly move through. Lynn, there's been a lot of work outside of the US. What are some of the things you can bring to this audience that's more US based from what you're seeing overseas?

Nate, on the manufacturing side, you've been part of some great round tables with secretary of energy, secretary of transportation. What are some of the takeaways from that, getting into the manufacturing space and jobs, and Carolina, you're working with organizations that are there on the ground? What are some of the things that any of us who are concerned about this or working on the ground can do to help and get involved? And then Gil, back to the kids, you've done amazing work bringing these lessons learned into the classroom, including through an outdoor learning environment. Just love to hear just the quick update on that. So we'll go Lynn, Nate, Carolina, and Gil.

Lynn Ames, Nuvve: Great, thanks. Yeah, so NUVVE has learned a lot through our 10 plus years working with TSOs worldwide, qualifying aggregated Evs, stationary batteries, and providing revenue generation and grid services. Our longest commercial deployment has actually been running continuously successfully for more than seven years, providing frequency regulation to a fleet in Europe, and we actually still have that customer today. So our technology really has unique functions, services, capabilities that are truly not being utilized here in the US market as they are in other parts of the world.

First of all, we're an aggregator, so we actually aggregate pools of resources to bid into markets with these resources or cars being ultra distributed, think everywhere in parking lots, garages, everywhere, and our software being ultra-fast responding, we have to respond very quickly to request from the grid on a subsecond basis in a reg up or reg down scenario in Europe, for example. We have the opportunity to inject and support the grid in a dynamic fashion with very rapid response. In the US, we've been heavily focused here or the market has been heavily

focused on demand response. What we'd like to see is market designs and programs taking advantage of flexibility services that the technology can provide so we can really unlock these resources on wheels and use them for their full potential to help stabilize the grid here in the US.

Sue Gander, World Resources Institute: Fantastic. All right, Nate.

Nate Baguio, The Lion Electric Co.: Thanks, Sue. Yeah, no, there has been a lot of interest and also the EPA administrator, Michael Regan, we just did a deployment with him in Alma, Kansas, which was exciting in addition to Secretary Buttigieg and Secretary Granholm in different parts of the country. Their questions and their engagement is how quickly can you do this? We need to do this now. There's urgency behind this, and the fact that cabinet members are meeting with the school bus industry is a wholesale change to what happened in the past 30 years that I've been working in Yellow Bus. So you can see the urgency that's moving forward, and to support Carolina's point, when you look at Lion Electric, we're building the largest medium and heavy duty EV factory that's dedicated only to that.

We're building it in Illinois. We're not running to a right to work state. We are doing it in the Rust Belt in the middle of the United States, which is exciting for our company, school districts, and workers. We're really focusing on that. The other part of this is really looking at North American sourcing. We're opening a battery plant as well and really bringing the control of our supply chain here locally, locally in friendly trade markets as we deliver these things. So I think that's a very important point and you can see there was a question in the chat, it said are you serious about that? Yes, we are. You can tell with how we're investing, where we're investing, and how quickly we're moving.

Sue Gander, World Resources Institute: Awesome. All right, Carolina.

Carolina Chacon, Alliance for Electric School Buses: Thanks, Sue. I think your question was what can we do? Well, obviously, I'd be remiss if I didn't just say, come to the Alliance's website, electricschoolbuses4kids.org with a four for the for to learn more. Sign up for our email newsletter and follow us on Twitter so that we can bring you into the fight for a clean ride for kids. I also want to mention that WRI has some really great resources and Electric School Bus Initiative also has a great site that can be a resource to really anyone, no matter what type of stakeholder you are. We're really focused on fellow advocates, but there's lots of resources out there including an equity framework.

We also have some equity guidelines and principles that we can share for folks that are working on electric school bus policy, but most of all, if there's one thing that I can leave you all with today is that there's more funding coming from the EPA. There will be a grants round coming soon this April. It'll be a competitive application process. So start talking to folks in your network and your community about applying. Let them know that help is out there, that

there are resources, that we can achieve this and we can do it together, and we can do it in a way that's really going to help our communities. So help us spread the word so that you can bring clean electric school buses and a clean ride for kids to your community.

Sue Gander, World Resources Institute: Fantastic. All right, Gil, close us out please.

Gilbert Blue Feather Rosas, Modesto City Schools: Thank you, Sue. I've worked with kids, student energy patrol at Stockton where fourth graders wore yellow jackets and green hats and talked about energy conservation, and I worked with students at Merlot Institute of Environmental Technology where high school students drew this story about a penguin and a polar bear that visited a panda in the transportation yard named Gilbert. So I really do see that kids are talking about solar panels and about electric buses and a lot of things that we say are supposed to be for the kids, but I think that's not enough. It has to be with the kids and promoting them. It has to talk about all these green career path choices. If we're having announcements from the EPA about funding, that is monumental.

If we have six SOLS, sustainable outdoor learning environments, that we're putting outdoor classrooms in our district, and again, that's a national record, converting half of your fleet with one thing. If we're doing all these special things, then our high school students should be there being junior reporters and experiencing the whole thing. Charge management people can make up to $90,000 a year. That's the career path that I want to show these students and these students in an equitable way. So I'm just saying that this is the right time and then the right idea right now. If people ask what should we be doing, it's about learning and attending all these webinars.

And the other thing that's very cool is as a school district, I just want to spray myself with spray bloom, grab as much funding and money as I can. I'm applying for everything that's out there, and so we just want to be a leader and show that Modesto's footprint of $5 million for all these different things was something that we can use in every disadvantaged community in the country, and so I put my email in the chat because I want people to contact me and ask and be involved with people like NUUVE and Lion Electric and Alliance for Electric School Buses. This is a great thing and WRI is leading the way too. So I appreciate Veloz and everybody on the panel.

Sue Gander, World Resources Institute: Fantastic. I know we jammed in a lot there, but hand it back over to Munni. Thanks, everyone. That was fantastic. Love all the contributions and definitely encourage people to follow up. So Munni, if you want to.

PARTNER SPOTLIGHT: THE EV CHARGING INITIATIVE

- Colleen Quinn, eMobility Advisors, Founder & President
- Munni Krishna, Veloz, Strategic Partnerships Director

PARTNER SPOTLIGHT: THE EV CHARGING INITIATIVE TRANSCRIPT

Munni Krishna, Veloz: Awesome. Thanks so much, Sue. And listen, Gill, I would give anything to see a picture of you dressed up like a penguin. So that might be going in the follow-up newsletter from Veloz along with the transcript. School bus panel, I'm going to let you guys go. Have a great rest of your day. I hope you stick around and let's keep it moving for everybody in the audience. That was a super fun discussion, and for those of you needing a quick break from the panels, you do have a few minutes, but honestly, I highly encourage you to stay because we've got a quick five-minute chat from our spotlight community partner, the National EV Charging Initiative.

And you are not going to want to miss what Colleen has to say. The National EV Charging Initiative, of which Veloz is a signatory, brings together automakers, power providers, electric vehicle and charging industry leaders, labor and public interest groups to signal that we are ready, willing, and able to support federal action on a national charging network for light, medium, and heavy duty vehicles. We're joined today by the founder and president of eMobility Advisors, Colleen Quinn, who has been a friend and mentor of mine in this industry for over a decade. So Colleen, you're here to share with us what you're up to in your state of the market. So if you're okay with it, I'll jump right into some questions.

Colleen Quinn, eMobility Advisors: I'm okay with it, Munni. Take it away.

Munni Krishna, Veloz: So we're not focused really on light duty charging today, but we can't ignore the $2.5 billion program that our keynote speaker just released last week. I was hoping you could share with us some background on standing up the National EV charging Initiatives, supporting the IIJA, and the Biden administration's ambition to deploy half a million EV chargers.

Colleen Quinn, eMobility Advisors: Hey, Munni, thanks so much for including me in the program today. Everything has run so smoothly, the presentations have been insightful, and by the way, yeah, we're friends, we're colleagues, but man, I think there's a future for you as a TV host on your resume. So many things set the table for this initiative. We have the maturing markets, we have the maturing technology, but the real game changer was the 2020 election because during that election, President Biden made a campaign promise to deploy 500,000 EV charging stations. We saw changes in the Senate where the Senate went democratic, and importantly, we saw some very capable appointments by the administration to put muscle in Washington DC.

So from the very beginning, we worked closely with the Biden administration and we gained their support and their participation for one real simple, but important reason, which is the administration viewed from the very beginning the importance of the private sector as being critical to both their message and their ambition to work with industry and set a new case for

electric vehicle adoption. So what we did was we brought together 35 national organizations that represented hundreds of companies, thousands of employees.

Veloz was at the table, thank you for your leadership. Front and center has always been the importance of collaboration, and we were able and still are able to demonstrate the ambition of this industry to step up to the administration. We profiled commitments from industry, many of them, Veloz members that would not have come together, but for the way we organize the summit and our activity, and finally, let me just end by saying the initiative was able to achieve something rare in public policy, which is the generation of goodwill, and that is something that the Biden administration appreciated as they launched into the most historic investment in EV infrastructure.

Munni Krishna, Veloz: Yeah. So Colleen, we've seen a lot together, a lot of which we cannot talk about on this stage, but since I have you, you're a pioneer, a thought leader in this space. Can you take a minute to share some lessons you've learned, especially in the context of this historic level of investment from the federal government?

Colleen Quinn, eMobility Advisors: Munni, thank you for indulging me and giving me a chance to reflect on my experience because primarily, I'm looking at this the way, certainly your first panel is looking at this as navigating uncertainty in a disruptive market. So here's some of the lessons that I'm excited to share. First of all, policy leadership matters. California has long been ground zero for EVs. Veloz is based in California and much of your contribution has really from the beginning brought companies together with government to support the growth of this market. As we mentioned, the president had a vision, and Congress passed the IIJA with historic funding, 5 billion in NEVI that will go through the states. This is really for the states, for the governors, for the policy leaders, a competitive issue, because the country/region/state that embraces these new trends that your first panel talked about on Demand and Mobility, Autonomous Vehicles, will have a substantial competitive advantage. Your meetings underscores policy leadership matters.

Secondly, it takes more than a village to deliver this new paradigm. I got to think back to 2010. I was in a hearing, and Nissan was in the hearing with me, and they had an aha moment. They said, "Wait a minute. We have to deal with public utility commissions to deliver a vehicle?" This was something they'd never even thought about or contemplated.

It's been complicated, this policy roadmap, and it's even going to be more complicated and needs to align further to enable this future of E-mobility. Today they talked about city planners and these opportunities, local authorities, whether if it's autonomous or eVTOL. Policymakers have an opportunity to rethink urban spaces and improve the quality of life for residents. But this means collaboration, and it takes more than the village.

Third, business models matter, but they will have to fight for success. Munni, it's been a bit of a David and Goliath struggle for us to stand up a competitive EV charging industry. Here's a few

lessons for others that are in that emerging market space. First of all, vested industries won't lay out a welcome map for you. Second, regulators really are looking for sustainable business models, and the role of private investment is critical to long-term viability. So keep your persistence on your business model and profitability will come.

Finally, we have to get to the how. Munni, I think we're actually aligned on the what and the why, but we need to continue to focus on how. We got to think about these investments to get to scale, and it won't be just on the back of government.

Munni Krishna, Veloz: Colleen, in five minutes sometimes you can teach us as much as an entire Bloomberg conference, so we'll take it. I'll let you go off screen, but for everyone in the audience, I highly encourage you to visit the National EV Charging Initiatives website and find ways to engage. Colleen, I will see you later, and thank you so much for your time.

Up next folks, we have a port panel, we punily named it "Sea" You Later, Emissions: Electrifying America's Ports. We've got our moderator, Matt Hart, Chief Executive Officer at Momentum. And joining Matt for this discussion are Kai Martin, VP and Chief Sustainability Officer of the Pasha Group. Leela Rao, Environmental Specialist at the Port of Long Beach, and Bonnie Soriano, Branch Chief of the Freight Activity Branch from the California Air Resources Board, Transportations and Toxics Division, which happens to be one of Veloz's founding members. Matt, I know we're a little over, take your time, and I'll hand it to you.

"'SEA' YOU LATER, EMISSIONS: ELECTRIFYING AMERICA'S PORTS" SPEAKERS

- Kai Martin, The Pasha Group, Chief Sustainability Officer
- Leela Rao, Port of Long Beach, Environmental Specialist
- Bonnie Soriano, California Air Resources Board Branch Chief – Freights Activity Branch (Transportation and Toxics Division)
- Moderated by Matt Hart, Momentum, Chief Executive Officer

"'SEA' YOU LATER, EMISSIONS: ELECTRIFYING AMERICA'S PORTS" TRANSCRIPT

Matt Hart, Momentum: All right, thank you Munni. Thank you Josh and the Veloz team. This has been an excellent conference so far. Really appreciate all the topics you have here and look forward to getting into the ports. So I'm going to start off with a little bit of context for everybody on the port space, and this was information as I was looking it up that was a little bit new to me, so it might be new to a few people. According to the DOE, there's about 40,000 commercial vessels and 360 commercial sea ports in the US transporting both human beings and the goods we need to live. Global emissions from all vessels account for about 3% of total greenhouse gas emissions annually. So taking the steps towards emission reductions represents a significant path forward to improve air quality and meet our nation's ambitious climate goals.

That being said, it's a massive endeavor to perform these projects, which is best said by our good friend at the Port Long Beach executive director Mario Cordero, when he stated, "It really takes everyone united with a bold vision and a detailed plan." To that end, I'm joined here today by an expert panel who are all currently working on transportation projects in the port space, looking at clean energy solutions, thinking about funding strategies, and actually deploying projects on the ground.

I'm going to dive right into it, and we're going to start at a high level. We're going to talk about the ethos, some of the strategies, and some of the tactics that these organizations are using to achieve their goals. So Leela, I'm going to start with you here. Your team has received over a hundred million in funding to move forward projects to demonstrate and deploy zero emission vehicles and infrastructure and the energy systems behind them in order to advance port operations. What role has funding played in the advancing technologies and clean energy goals in your team?

Leela Rao, Port of Long Beach: Thanks, Matt. Honestly, the funding has been critical for the port and our tenants. Many of our early grant-funded projects went toward technology development, so we're talking deployment of one or two pieces of electric equipment and the associated charging infrastructure. These projects taught us so much, and by us I mean not just the port, but the technology providers, the terminals, the permitting agencies, utilities, everyone involved in these projects. The lessons learned went into improving the equipment, making different decisions when looking at what kind of charging infrastructure to procure, refining port standards, and so much more.

Importantly, we also got some early grant funding development for our port community electrical vehicle blueprint to identify a high level path towards zero emission. That initial blueprint laid the foundation for the detailed terminal specific zero emission infrastructure master plans that we are now working on with all of our container terminals so that we can more effectively go after grant funds for large scale zero emission equipment deployments that will enable the complete transition to zero emission terminal operations.

The bottom line is this transition to zero emission equipment is extremely expensive, and the grant funding is essential to help make it a reality so that we can reduce the criteria pollutants that are impacting the communities surrounding our ports and help the planet by reducing greenhouse gas emissions.

Matt Hart, Momentum: Thank you, Leela. I know that your team has really been pushing a lot of the envelope in how do we demonstrate and deploy technologies, and a lot of that has been on the port space, but I want to pivot for a second to Kai over here with Pasha Group. So Kai, Pasha Group has been providing diversified global logistics and transportation services since 1947, operating terminals and vessels, including Pasha Hawaii, one of the nation's leading domestic ocean shipping companies. Can you walk us through the journey of going from a

traditional fueling method to delivering an LNG-powered vessel? Talk to us about how alternative fuels and other Pasha efforts in the ports support the overall commitment to zero emissions port operations.

Kai Martin, The Pasha Group: Yeah, thanks Matt. Thanks to the Veloz team and everybody else. Yeah, I think you captured it well. We're a third generation privately owned company, and it has been quite a journey. And really our journey's been on a couple of different fronts. Number one, as you mentioned, is the vessel side. We had several, four ships really, that were 40 years old or so steam ships, and so those ships needed to get re-powered or replaced depending on where they are and what we could do with them. And years ago, probably like eight, nine years ago, that was really the start for that journey of well, what's viable, what can we do with it? And then how do we get there? And the other track that we're on with the journey side is on the port front. What's the maritime adjacent stuff that we need to do? Are there pieces that mutually support each other? And so how do we dovetail together to make those happen?

You talked about in the original question about the ethos and stuff like that, this topic area. Privately owned company, the Pasha family, their strong proponents of being good stewards to the employees, communities, environment, and other stakeholders, in this case ports are stakeholders and the port communities, of course, that they're operating in. And we need to transition to cleaner and lower fuel footprint fuels. And so when we did the assessment and the journey of what is truly feasible, LNG's been around for a while, that doesn't necessarily make it easy, but it's been around for a while, and there really isn't any other option that's a lower footprint fuel right now.

At the time of deciding this, LNG was really the most viable option. Even today, most shipping operators must secure their own supply lines with those being suboptimal, imposing new constraints, just to use LNG, which again has been around for quite a while.

Permitting a bunkering of the storage of the ship itself present many challenges that don't exist for traditional marine fuels. The shipyards can stamp out diesel vessels pretty easily, and those go through really well. And every LNG ship is going through its own hurdles that are trying to get permitted right now. Interpretation over what's acceptable risks, and what's the right types of piping and how do we put this all together. Each one is a custom job, and so that just really draws out those timelines, makes everything a little more challenging working with regulatory agencies, et cetera.

Permitting of the bunkering, of the storage, of the ship itself present challenges that don't exist for traditional marine fuels. There's already all that bunkering infrastructure set up for other types of marine fuels, but we talk about hydrogen-based fuels and alternative fuels, there's nothing there.

Our journey started with, well, what's feasible? What's out there? Where do we see on the roadmap? In one of the previous panels, they talked about future-proofing things. What's leading edge, not bleeding edge, but what's leading edge, and what's commercially feasible? We have a certain number of ships. They're extremely capital intensive to build, and these have to last for a couple of decades at least. And so what can we put into place and will work on day one, can be supported, and can go into the future. And we had to look at do we have merchant mariners who are trained to operate LNG ships or do we have to set up our own program?

And so the journey took a lot of different places. How do we get the fuel? Where do we store it? How do we bunker it? Do we have people that can operate it? How do we contain the methane slip to maybe even be zero? What's the transition plan from regular traditional LNG to RLNG or other types of biofuels, renewable fuels, that can be even maybe carbon zero sort of a net there? And what are the storage space and cost of fuel trade offs? Those are just a lot of the different things that went into figuring out how do we make this journey.

And then coupled with that, and one of the things I didn't mention is we have one ship that we've launched last year. We have one ship that's going to be coming out this year, that's dual fuel LNG, and we also have one 40-year-old steam ship retrofit that's coming out this year that's also a dual fuel LNG. And that's the first of its kind in the world of taking a steam ship and retrofitting it to a cleaner alternative fuel, like a dual fuel LNG-type-of burn.

But we're not only focused on the vessels, like I said, we were also working in the port environment. We've been party to various proof-of-concept and prototyping different ideas and projects. We've been working on on-road, off-road types of terminal equipment, looking at emissions capture barges. Pasha right now one of our joint partners, West Coast Clean Fuel, is the first permitted marine fueling of a hydrogen craft in the United States. And we have a hydrogen ferry that's not Pasha has, but as part of our partnering here, we're going to be supporting a hydrogen ferry that's being placed in the service in the San Francisco Bay area. And we're got several other marine fueling options that are going out there to look into other types of hydrogen fueling that can be done for marine vessels, whether they're ocean going or harbor craft.

I don't want to take too long, but our journey's been a long one. It really started aggressively, I would say, in the 2014, 2015, but maybe even a couple years before that, looking at what's feasible and then just it's been almost a decade to actually get to where we have commercially viable pieces of equipment that are getting placed into the operating environment we're trying to do. We still have some pretty exciting projects that we're working on, and I think I'll talk about those in some of the future questions. Thanks, Matt.

Matt Hart, Momentum: Yeah, thank you. Kai, and I'm sensing a theme here, Leila and Kai, in the amount of lessons learned through these demonstrations. Not only is it the challenge of the specific target technology, but across the supply chain and the whole network that you work with, there's impacts that you're learning through these demonstrations.

Kai Martin, The Pasha Group: That's right.

Matt Hart, Momentum: I think that's a great transition in and following up on some of what Colleen mentioned about the importance of policy in driving this. Bonnie, I want to check in with you here as we think about the manner in which CARB has been a leader in advancing these technologies and in supporting them as well through the development and the transition that it's looking to see at the state and national and global level. Can you talk to us about how and when CARB got involved with port decarbonization projects from the regulatory side, and how that's evolved over time with new regulations?

Bonnie Soriano, California Air Resources Board: Sure. Yes, I'd love to talk about that. And thanks, Matt, for teeing up the question, and Veloz for inviting the Air Resources Board here to speak. And if I go too far down a rabbit hole, somebody give me a little signal, because when we talk about history, I can go down a rabbit hole.

But essentially I wanted to make a few points. One is that when we look at the air pollutants, we don't necessarily look at them in isolation. We can talk about decarbonization, and I'll talk about decarbonization here, but at the same time, we're talking about greenhouse gases. We're talking about air toxics. Diesel PM is an air toxic and is a carcinogen. And then we have, of course, the criteria pollutants like knots and ozone and PM, which have their own health and regional air quality impacts. And so when I talk about things I kind of use, I speak about it in umbrella terms, although I'll focus on the decarbonization part.

And then the second piece is that through the years, and I'm going to go back to 2000 and talk about what some of the drivers are. There have been many drivers over the years to get reductions from the port communities, starting with when I recently started at the Air Resources Board, we had what was called the Risk Reduction Plan. And the goal of the Risk Reduction Plan was to reduce risk from diesel particulate matter by 85% by 2020. That was one of the original drivers on our work at the ports.

And then, of course, I'm pretty sure all of you are familiar with AB 32, which is the Global Warming Solutions Act, which was in 2006. That was one of the early drivers for decarbonization. And then through the years, there have been goods movement, emission reduction plans. Our board directed us in 2018 to get additional reductions. There's Governor Newsom's executive order to go to zero emission by 2035 for those areas that are feasible. A lot of drivers, and including federal requirements that we meet are regional air quality standards, PM, ozone, and those result in state implementation funds. A long history of drivers for reductions across the board.

What I do want to say, and as Kai was talking, I was thinking about I wanted to make sure that we give credit where credit's due. This is not one entity acting alone that has been able to reduce, for example, the diesel cancer risk by 85%. This has been a huge effort by a lot of parties. As Kai said, industry, the ports, the state government, the federal government, the

community groups, labor. I mean, this has been a huge effort and going on for now we're in our third decade of it.

That's kind of the history. Just in terms of the equipment sectors, we have gone through really the five equipment sectors that we're involved with in our division are the large ocean-going vessels, the commercial harbor craft, the cargo-handling equipment, and then in another branch, not my branch, but drayage trucks and locomotives.

We have been through, as early as, I looked up some of the dates, as early as 2006, we had our first regulation for cargo handling equipment. We went through, and those were the initial regulations for most of the equipment sectors in those between 2005 and, I think, 2012. We developed regulations for all of those. Some of those were different pollutants, and for example, the at-birth regulation, which we brought to our board in 2007, was an early action item for AB 32, because we're plugging in vessels to reduce greenhouse gases.

And so long history. We have, at CARB, regulated most of the sectors the original time, and now we are coming back through, because our board directed us in March of 2018 to get additional reductions from some of these sectors. That's a 23-year history in a nutshell. And so I think that those were most of the points that I wanted to make and would be happy to provide more information in any of those areas.

Matt Hart, Momentum: And I feel like we could probably do an entire panel on just the history of this. Congratulations for making it through quite a extensive history in a quick time. I appreciate the overview.

Let's get into a little bit of the project specifics themselves and some of the on-the-ground work. And Lela, I'm going to start with you here. We've been fortunate to work with you through the development of the START program, Sustainable Terminals Accelerating Regional Transformation. This was funded through the ZANZEFF program with 50 million from CARB in order to demonstrate ZEV technologies at the Port of Long Beach, the Port of Stockton, and the Port of Oakland. It was quite a collaborative effort here. Can you tell us the goal of the program, some of the technologies that have been demonstrated through it, and some of the early impacts on the ports? And we'd love to hear about some of those first of their kind electric forklifts.

Leela Rao, Port of Long Beach: Sure. The goal of the START project is to demonstrate what a sustainable seaport facility of the future could look like, right? It's containers, vessels loaded on to zero-emission yard tractors handled by zero-emission rubber tire gantry cranes, we call them RTG cranes, transferred to zero-emission trucks, and all supported by energy efficient strategies, community partnerships, and workforce development initiatives to facilitate the statewide transition to a cleaner freight transport.

The major components of this particular deployment include zero emission terminal equipment. That includes forklifts, yard tractors, top handlers, RTG cranes, and a rail car mover.

We have battery electric drainage trucks. We have tier-three container ships. They're actually ConRos ships, so a container and roll-on/roll-off vessels. And then we have a new addition to the project, the last minute here, a plug-in hybrid zero-emission-capable tugboat as well.

The project got going in earnest in 2019. As you might imagine, we encountered a lot of challenges the first few years with the pandemic and the impacts of the global shutdown, subsequent cargo surge, supply chain, crazy labor issues, you name it. That said, we managed to make some pretty substantial progress over the years. The electric forklift fleet has been up in operation at the Port Stockton for over a year, as has their electric rail car mover. And it's been going relatively well, but this is one of the first of its kinds.

And the deployment has had its share of challenges, such as the fact that our smaller 8K forklifts aren't quite robust enough for the rigors of the port environment. Our large 36K forklifts are in fact so large, they can be difficult to maneuver in some situations. They're not quite a one-to-one replacement for their diesel counterparts either.

That said, I think one of their great impacts of this project is that our terminal partner, SSA, has been happy enough with the heavy forklifts so that they got from START, but they've gone and purchased additional units to help fill out their electric fleet. That just shows the success of the program, and how getting these early deployments is helpful for people to accept the technology and really move it forward.

In addition, we have our electric RTG crane fleet, so all nine of those are up and operational, as are our electric top handlers and drayage trucks that are operated by our partnership with Transport Express up at the Port of Oakland. And I think personally for me most excitingly, it's looking like we're a couple months away from being able to commission our fleet of 33 electric yard tractors at the SSA terminal here in the Port Long Beach. It's been a super long road, and these atmospheric rivers aren't helping much at the moment. If we can just get the rain to stop, we can commission these things, and it'll be such an accomplishment once you've got this largest fleet of human-operated zero-emission terminal equipment up and running here at our port.

Matt Hart, Momentum: That's really exciting. And while I've got you, I'll pick on you a little bit more. Since you've seen a lot of things in this program and others, are there any particular wild stories or challenges that you just didn't quite think you were ever going to find yourself in?

Leela Rao, Port of Long Beach: Yeah. I mean there have been some real doozies over the years. I think one of the more bizarre things to have happened occurred with one of our early attempts at doing a pilot demonstration of a hydrogen fuel cell yard tractor. Somehow the technology provider didn't really think about how these vehicles are going to be operated and the maneuvers that drivers make when carrying a container around the terminal. When the unit was first delivered and first tested carrying a load, we found that the corner of the container would hit the hydrogen fuel tank mounted on the side of the yard tractor when it

turned in one direction. And so as much as we like to joke that it's like a racetrack out there on the terminals, we can't have yard tractors only turning left to avoid hitting the fuel tank filled with hydrogen on the right. Right? As you can imagine, that part of demonstration was scrapped, and we never did get the test out a hydrogen fuel cell yard tractor. I'm sure we'll get there one day, but I'm fairly certain it's going to be with a different technology provider.

Matt Hart, Momentum: That is definitely not an outcome you were expecting, I'm sure.

Leela Rao, Port of Long Beach: No.

Matt Hart, Momentum: Well, Kai, let me turn to you. As you mentioned, you knew this question was coming. As you've been working on several port projects across the PASHA group and its operations, you're been working with renewable energy, electrified equipment, what other zero-emission port projects has PASHA worked on, and what has been your experience there deploying new technologies? And feel free to add in any wild or crazy stories if you haven't.

Kai Martin, The Pasha Group: Yeah. Hey, thanks a lot, Matt. Yeah, and Bonnie, thanks for bringing that up as far as all the partners that are involved with this. I think in my last thing, I was saying the word PASHA a lot or something, or in reality there's just all these different people, whether it's the actual solutions providers, port entities, the fire department, whoever it is that's all involved, but CARB was a big piece of that too.

One of our earlier projects was actually by virtue of Port of LA and CARB engagement and grant, where we were working on retrofitting diesel equipment, forklifts, top pickers, tractors, from diesel to electric, to EVs. We had also some on-road drayage trucks. We did a barge carbon capture as well as emissions project that seemed promising, but ran into some hitches here and there. And also battery energy storage systems, upgraded crane drives, regenerative crane energy, and then obviously solar PV systems, microgrid systems, and now we're pushing in with some additional wind, but not super huge 300 foot wind turbine, but really wind micro cubes that generate a pretty terrific amount of energy too, or at least hopefully will.

Those are just some of the things that we've been working on. As far as we had first generation on-road trucks, EV trucks that have a 52-mile range and are almost unusable unless it's a shuttle of only a few miles from the terminal to somewhere else. We have generation two trucks that are slightly better, but still not awesome. And I think some of the types of things you run into is a lot of this is leading edge, as Leela mentioned with the hydrogen truck, we've had two thermal fires with two different pieces of EV equipment that just sort of, not quite spontaneously, but some moisture got into the battery section. And that undermines confidence in what's being provided. Are the partners you're working with going to be around tomorrow? Or do they have a robust supply chain that's US based? Those are some of the really big troubles we run into.

Things are buggy. We had an on-road drayage truck that was re-powered EV that just would stop while going over one of the bridges in the LA/Long Beach area going upgrade, which is scary for the driver. And there was no real reason, so it was essentially a software glitch. There's just a lot of different pieces that we've been working through.

We had a battery energy storage system that we put into play, and it took us... Well, it was finished in 2017, and hopefully in the next couple months, we will get the final fire permit to actually put it into service. So 2017 to 2023, it's just been sitting there. The batteries are still good, but it took way too long, and the permitting regulations changed. The fire department's codes changed over the years as well as different people put battery energy storage systems out there. They've been upgrading their standards as we're trying to get this commission. Those are the types of things that you wouldn't have foreseen when you first just said, "Hey, I'm just going to buy some batteries, and we're going to be able to plug it into a microgrid, and we're going to call it a day."

As Leela mentioned, the marine environment's a tough one. You might say, "I have a forklift that can run eight hours." "Great. Can it go up and down on a railroad ship and run eight hours?" "Oh, no, it can't." "Darn it." Now it only runs six hours. Do we have 34-ton or 50-ton forklifts? California has this great CORE program, the off-road, the E, but anyways, they've identified all these different makes and manufacturers of forklift. But you can't find a 34-ton forklift on there or a 50-ton forklift.

And so there's a lack of a viable equipment that's there. They're slowly getting there. The suppliers are getting there, but you need it to be feasible. I think Bonnie you were saying, or Leela, if you want to get to one to one, if you want a diesel parity, if you want to say, "I'm getting rid of 10 diesel tractors that are old and replace them with 10 something cleaner," it has to work. It has to be a 10 for 10. You can't tell me, "Well, for your 10, you're going to have to buy 15 of the others. And oh, by the way, they cost twice as much." Even with grant funding, it still doesn't really work out.

We've been looking at hydrogen trucks for a while, and we're within about 2000 pounds. If we can get the truck cab down 2000 pounds more, then we could carry a hundred percent of our cargo on certain lanes, and that's pretty exciting. But then we went and talked to insurance brokers and trying to find an insurance broker who will give you money on something that's very cutting edge at a reasonable diesel parody rate for insurance is very hard, and that doesn't come into the grant funding space. How will you actually pay this? What's the TCO on this? So having a robust ability to do that, total cost of ownership, factoring in all these different pieces that are beyond just what's the sticker price, and what's the grant funding to pay for that to offset that sticker price.

Those are just some of the things that we've been trying to pick through. And we have two different projects right now in the ports. We have one in Port of LA and one in Honolulu where we have better energy storage. We have crane regeneration, which will reduce the crane draw

by right around 60% or so in some cases. We can get a lot of energy back into a better energy storage system. We have solar going up. We have different types of generators we can use, maybe even potentially hydrogen-based fuel generators on dock to help re-power things. We also have these wind microcubes that I talked about earlier. And then, of course, lots of different EV options, whether it's just the pickup trucks being used in the terminal or the tractors or a lot of those other pretty promising technologies.

And then, are those wireless charged? Are they in ground? How are we going to do that? There's some really exciting things that a couple ports are trying out with the wave chargers. The cost for those is much higher than your regular EVSE plugins, but there are some operational aspects to it too that maybe pay off in the long run.

So I was just going to mention a few other changes. Lease agreements with ports. If you have a 25-year or a 40-year lease agreement between the terminal and the port, is that something that you want to reopen to start putting in other pieces? And what leverage does the port have to help to help it's marine terminal operators make that transition and what can be reached between the two parties? Can you get a power purchaser for a solar system if you only have a lease for five years? How will that work? And so there's a lot of different nuances that people get into. Maybe the technology is available, maybe it's operationally feasible or commercially feasible, hopefully both. But then there's all these other little nuances that you get into that really delay, doesn't make it impossible. They're just all considerations that need to be built in. So a lot of lessons learned.

Matt Hart, Momentum: I really appreciate the detail here because that is the value of a lot of these early deployments in making sure that we're learning that. And I appreciate all the folks here in pushing through those, not going, "Okay, we did this once. This is exhausting. V1 didn't quite work, I'm going to wait to V4." It's like, "No, we know it's the right direction. We know it's the way we want to go. Let's get through the next few versions." And I want to make sure that we don't miss an opportunity to talk about not the what we're doing, but the why we're doing it.

And Bonnie, I'm going to go back to you here on this one. CARB measures air quality and they are around to support the improvement of air quality in our state. Ports are a major economic driver and there's a balance between, at least historically, driving the economy and emissions. And can you talk a little bit about how CARB has supported these competing efforts and how it has been organizing regulations in order to actually achieve the outcomes we were looking for, which has improved air quality without diminishing the economic viability of our state and our region and supporting those individuals who live and work near ports?

Bonnie Soriano, California Air Resources Board: Great. Yeah, I think that that's a big component of the drivers for reducing air pollution. I think ultimately it is the health impacts to the

communities and to the environment. So that's the driver, just like I was talking about before, the air quality, regional air quality, global climate change and then the health impacts to the residents that live around these huge freight facilities. And so the health impacts have always been a driver for reducing pollution. And as you did mention, and I don't have the statistics in front of me, but the ports are a huge economic driver in California. We import something like a third of the nation's containerized goods. Can't remember, somebody else probably knows what that metric is. But essentially all of this is coming through the communities that surround those ports. And so we recognize, one, the importance of having that economic driver for our state, but also the fact that those communities need to be protected and we can't grow the ports unless we can protect those communities.

And so really, it's a balance between ensuring that we have economic competitiveness and ensuring that we're protecting the residents, the communities that are around those ports, and I don't know if the attendees here are familiar with, there's a program called CalEnviroScreen, which identifies communities that are disadvantaged, meaning that they are in the top, I think it's 85% of impacted from economic health impacts from pollution. And so if you look at the port regions, the ports are ringed by those communities, those disadvantaged communities, and one of the drivers is because of the air quality in those communities around the ports. So it's super important. We have with the adoption of AB 617, which is the Community Air Protection, can't remember exactly the, Bill, where the communities are given really a more comprehensive role in determining what's important to their communities. It's not just the state saying, "Oh, this is what's important to your community."

We're actually going out to those communities and letting the communities determine what's important to those communities in terms of how the health impacts from the freight sector is impacting them. So AB 617 has been a huge driver I would say in the last five years to have communities play a bigger role in defining how they want to tackle the air pollution issues and what components are important to them. So that's the community piece. Just back a little bit in terms of the regulations, we have regulations for all of the equipment sectors I talked about and as a part of our board's direction in 2018, getting additional reductions from all of those sectors.

And I just wanted to give a shout-out. We have two regulations that are going to the board in April, the locomotive, in-use locomotive, and then the drayage fleet, which Kai talked a lot about the drayage fleet is being included. It used to have its own separate regulation and now it's being included in a fleet regulation called Advanced Clean Fleet. Both of those are going to the board in April.

In the last few years, I'd say the last three years, my branch has brought amendments to the Commercial Harbor Craft regulation to get additional reductions across the board from Harbor Craft. And we also brought a new at berth regulation where we added additional vessel types, so container vessels, cruise vessels and refrigerated cargo vessels have been regulated and have been shore powering since 2014. Now we're bringing in the Roll-on, Roll-of vessels and

tanker vessels in 25 and 27. And so we've had a lot of regulatory activity in the last few years to achieve the direction from our board to get additional reductions, and that is specifically for those communities that ring the ports.

Matt Hart, Momentum: Thank you for that. I think that's a great summary and I know I've had the good fortune of working with everybody on this panel at some point, and I know everybody here takes their community very seriously and has very strong engagement efforts to work with them, to coordinate with them, to help share in an educational dialogue that goes in both directions. And then we're all doing the work for those communities and for that reason, I appreciate the leadership that everyone here shows in driving this forward. And before Munni gets too mad at me for letting this go over a little bit, I'm going to pass it back to you.

"POINT A TO POINT B: HOW E-MICROMOBILITY CAN GO BIG" SPEAKERS

- Tejus Shankar, Lyft, Policy Development Manager
- Julia Thayne, Rocky Mountain Institute, Principal
- Ruben Aronin, Better World Group, Principal
- Laura Krull, Metropolitan Transportation Commission, Bikeshare Coordinator
- Moderated by Dianne Martinez, Garfield Foundation, Director

"POINT A TO POINT B: HOW E-MICROMOBILITY CAN GO BIG" TRANSCRIPT

Munni Krishna, Veloz: Awesome, thank you so much Port Panel. We are going to let you go and enjoy the rest of the summit. I really appreciate all of you guys. You can go off camera and on mute.

To everybody in the audience. Congratulations. You made it to our last panel, so it is time for that $300 Visa gift card. Hey Dianne. On behalf of the Veloz team, I want to say a big congratulations to Mike Westlow, Director of Electrical Contracting Partnerships at Go Power EV. You are our lucky winner of $300, sir. I hope everyone is congratulating you in that chat or at least negotiating with you how you can use that money. I have some ideas, but let's get right into our final panel.

On the screen here you can see Dianne Martinez. She is the former Mayor of Emoryville, the previous Chair of East Bay Community Energy, a current Veloz Public Policy Board Leader, the current Director of the Garfield Foundation, and last but not least, a good friend of Veloz. Our amazing panelists include Tejus Shankar, Policy Development Manager at Lyft, also a Founding Member of Veloz; Ruben Aronin, Principal at the Better World Group; Julia Thayne, Senior

Principal at the Rocky Mountain Institute; and finally Laura Krull, Bikeshare Coordinator from the Metropolitan Transportation Commission.

Dianne, it's all you.

Dianne Martinez, Garfield Foundation: Great, thank you so much Munni, and thank you everyone else for sticking with us. I know the big award went out for those people who've been here since 9:00 AM but I hope we could keep you interested in staying with us all the way through the end of our presentations today. We've got a great panel ahead of us. We know that e-micromobility is a big piece of clean transportation, and interestingly enough, the ridership demand and capital investment in global micromobility took a massive upswing in the last two years.

Recently in the news, we've been hearing a lot about 15-minute cities from Paris, France to O'Fallon, Illinois where cities are being built so everything you need is in within a 15-minute walk, scooter or bike ride from home. And today I'm joined by an expert panel to discuss driving even more investment into e-micromobility, charging strategies and what measures need to be taken so that these programs are delivered in an accessible and equitable way. But before we jump into today's session, we have to point out that our very own Julia Thayne from Rocky Mountain Institute actually just did a podcast on this topic with our keynote speaker and self-professed electric bike nut, Gabe Klein. And Julia, I wanted to turn to you first and find out what were your key takeaways from that conversation.

Julia Thayne, Rocky Mountain Institute: Amazing. Well, thank you Mayor Martinez. It's so wonderful to be with you today, to be with the rest of this panel today. As you mentioned, I'm wearing multiple hats, so I'm a Senior Principal at Rocky Mountain Institute working on heavy industry and heavy transport decarbonization in LA and Houston, and then also work for something called Micromobility Industries where I'm a Co-host on a podcast called Ride On. I did get a chance to interview Gabe Klein a few weeks ago, months ago maybe at this point, about his new job. And you all are going to hear from him. You know that he has a huge job in trying to dispense $7.5 billion across the nation to create a backbone of charging infrastructure. What's interesting is I've known Gabe for a while, so I've seen him across multiple jobs and in most of his jobs, it's actually not been about vehicle electrification. It's been about urban design, it's been about bike infrastructure, it's been about shared bike systems.

It's been about trying to get as many people to feel safe and to actually be safe on roads where we're seeing increasingly large, increasingly heavy, and even increasingly electric SUVs and other things. And so from that conversation, Mayor Martinez rather, excuse me, I had two key takeaways, one of which is around both end and the other, which is around rural and urban. So in terms of both end, Gabe was singing a slightly different tune than I've heard him hear or say before, which is this both end logic around how we need vehicle electrification and reduction in vehicles miles traveled. And that's relevant to a lot of the research that we do at Rocky

Mountain Institute around just setting targets for the US for 2030 on how many electric vehicles we need on the road, plus this 20% magic number of reducing vehicle miles traveled so that we can stay in alignment with this 1.5 degree Celsius target by 2030.

So both end was a key takeaway from that conversation. The second one is rural versus urban. In a lot of the conversations we have, even around micromobility, there's a sense that these solutions or electric vehicles are only for urban locations, not at all true. We have to stop this rural versus urban, and think of it as rural and urban. And I think Gabe, for necessary and potentially political reasons, although he would probably say otherwise, has to think about the charging infrastructure and the corridors spanning a country that in itself is topographically and geographically diverse. I think similarly in micromobility, what you're seeing is that we have so many different vehicle types, so many different business models that no longer is this an only urban solution. This is really something that can be tailored towards anywhere you live.

Dianne Martinez, Garfield Foundation: Julia, everything you said really speaks to my heart and I could not be more proud that we have someone like Gabe at the Federal level who is advocating for the fact that electrification cannot be seen in a silo. We need to bring together these advocates from the bike ped space, the transit space, and the housing space to reduce that VMT. I am so in line with that message and I really think everyone should listen to that podcast. I've got chills, but next up to keep things moving along, we're going to get right into the market product and program expansion. And our first question is for Tejus at Lyft. Tejus, what is Lyft's strategy to both meet today's demand and continue to grow more clean last mile transportation solutions? And I know you can't reveal trade secrets, but did your entire strategy have to change when the market made this huge shift?

Tejus Shankar, Lyft: It's a great question. Thank you so much Mayor Martinez for having me, and it's such a privilege to be part of this wonderful panel with such great panelists as well. So overall, Lyft's transit bikes and scooter team, that's the team that I'm part of, is core to Lyft's mission to build cities around people. And if we're thinking about that 20% reduction in VMT, we really see, as Julia mentioned, we really see shared micromobility as a core part of that mission.

And actually in that process of we're thinking more about our strategy last year, Lyft acquired PBSC Urban Solutions. They're a global supply leader for bikeshare equipment in technology. And through that acquisition, we were able to expand our footprint of shared micromobility beyond North America and now have a global footprint across the world. And so now as a leading operator in North America and also as a hardware and software provider in over 50 cities around the world, our team really has a deep understanding of how cities work, what do riders think about and how do we really create this framework in order to actually meet this shift in demand that you're talking about.

If we're talking about that shift in demand overall, just as a sense of where the ridership levels have been, our ridership has been 50% higher than it was pre-pandemic. So we've seen considerable growth of shared micromobility use, and then we also had our best ridership season last year, and it's been constantly growing year over year. So we're really excited about that boom and what that might mean. But we also see as an operator, truly the way that we see this growth and we see the opportunity for growth is through our city partnerships and we really see true public private partnerships as a way forward to enable this shift in demand.

We really see also the way that we think about our station based network and our docking stations as a key to that success as well as investments that we've made to develop a really great e-bike that's fun to ride for riders, but also really has much stronger operational efficiencies. So taking all those into consideration that that's been a really big part of our growth strategy and really thinking about how we can shape true public, public-private partnerships have investment from the city, we think public funding is key to that. And so really appreciate all the support from MTC and Laura. So thank you and you're on the panel as well and really see that as a key to success for our systems going forward.

Dianne Martinez, Garfield Foundation: That's awesome. I can see how using that real-time ridership data can actually just drive your success and those partnerships with local government who are creating that bike ped infrastructure that supports e-micromobility as well, is so important to have connected streets and networks so people feel comfortable and safe getting from one place to another. I know in a city like mine, which is Amaritha, California in the East Bay just across from San Francisco.

We don't have our own train station, so we rely on that e-micromobility to get to our local train station in Oakland and get around town and cities need to do what they can to support that type of transportation. So we're going to move back to Julia next. Julia, last year you sat on a panel and noted that folks tend to think of e-micromobility as a leisure activity, and in that context it's been really private capital funding in the industry as opposed to the way that state or Federal policy drives the electrification of other transit. So can you talk to us about what measures need to be taken to inspire policy support and funding at the Federal level? And I know the pot is there, but how do we really funnel it so that we get what's actually necessary, given the already existing private capital investment?

Julia Thayne, Rocky Mountain Institute: Yeah, Mayor Martinez, I think you make some really good points, even just speaking to your experience about Emoryville, in that micromobility is not only a leisure activity and these aren't only leisure vehicles. And it kind of pisses me off honestly when we talk about them as such because they're used in all sorts of ways, especially if you are living in a city like LA as I am, and you just look around and notice that a lot of people aren't using these as leisure vehicles. They're using these as livelihood vehicles. So just a few points, I think, to your question around private capital, what government's doing, what

federal policy should be doing. Private capital has been funding the industry. I would argue that the amount of funding that they've put into the industry is not really enough. If you look at all of the investments that have been made by venture capital into transport, only about 6% of those investments have been in micromobility.

And that was early on in micromobility. So that was in Bird, that was in Lime, that probably was in Lyft too, sorry Tejus. And it was in shared micromobility services. That represented one kind of model for the industry. It is not the only kind of model for the industry, and we're seeing much more uptake of private ownership of micromobility vehicles and many more types of micromobility vehicles. The industry is really changing. We need more investment from the private sector. Fortunately, I would say government is actually taking action. Maybe it's at the local and state government level as opposed to at the Federal level, although I'll get to that in a second because we've had some exciting new announcements in that space just yesterday I guess. But I do, as probably multiple people have on this conference so far, want to give a shout-out to City of Denver for their e-bike voucher program, which has been wildly successful.

They've done a great job at capturing data on the success of it and also just making a voucher program that was equitable by design. Hawaii, DC, there's a number of other states that are doing a bunch of work on voucher and rebate programs. Finally, the Federal Government is kind of showing up. It's like dipping its toe in the water of looking at how support could be for e-bikes. We have something called the E-Bike Act that was introduced yesterday. So $1,500 off of a bike or a micromobility vehicle, I think just an e-bike up to $8,000 bike costs. I think this is going to do three things or I think it will do two things if it gets passed, and hopefully we will spark interest in the third. One is purchases. Just $1,500 off of a bike actually gets you a free electric cargo bike.

So there are some bikes that are less than $1,500, you're essentially getting a free bike. The second thing is, unlike EV companies, which many of whom we saw raise prices when they didn't qualify or when they thought they did qualify for the EV tax credit, Rivian, Tesla, I think e-bike companies are actually going to drop their prices. So we're going to see more e-bikes that are below $8,000 if this passes. And then the thing that I hope this spurs is manufacturing incentives.

We have so many manufacturing incentives for auto OEMs. I mean it's, and for like a hundred years. So why can't micromobility companies get incentives? We have a lot of really interesting and fantastic micromobility companies that are in India, the Philippines, East Africa, Europe, China. How can we get them to do more of their distribution, manufacturing, processing, assembling here in the US? And not to make that sound too political, but in any case, what I mean is we do need to have more of the manufacturing assembly or could have more of the manufacturing assembly happening in the US if the Federal Government wants to put somebody behind it.

Dianne Martinez, Garfield Foundation: That's great. I hope there's some decision makers in the room today taking notes because you have so many great things to say. Yeah, the E-bike Act that just came out, this is a second time around, I think, and hopefully there's more coalition support bringing together people from those diverse fields of social justice and environmental activism along for the ride this time. So hope that goes through. And there are also more local municipalities and who are interested in those incentives as well.

And actually, this helps me pivot to our next question, which is going to be for Laura at the MTC. Thank you so much for joining us. While it's fun to talk about the multi-billion dollar investment side from the Lexus Sequoia Capital, but at local investment, as Julia was saying, those are really, really important and critical too. And I get to pivot to one example from my former team over at East Bay Community Energy who recently announced a $6 million e-bike lending and incentive program. So Laura, focusing in on the Bay Area, can you talk to us about efforts that have worked to promote?

Laura Krull, Metropolitan Transportation Commission: Yeah, thanks, Mayor Martinez. I think what's been particularly interesting about the local efforts, especially in the Bay Area, is that there's a couple of different approaches. Over the last couple of years there's been a number of, as you mentioned, the community choice energy aggregators. And a lot of those have launched e-bike rebate programs, and at least in the Bay, these programs are often equity focused. And Julia mentioned Denver's program as well. So there's an income qualification for customers or residents, and then they receive either a certain percentage of the bike price or up to a capped amount for purchasing their bike.

And this can really address one of the big barriers, which is the high upfront cost of e-bikes, particularly for more income constrained individuals. But more recently we've seen some e-bike lending libraries as the program that you mentioned as well. And one other program to keep an eye on is the City of Oakland's program, which is aiming to launch in Oakland and to bring it back to funding, that one was funded by a grant from the Clean Mobility Options Program.

So definitely seeing more funding opportunities popping up as well. And these e-bike lending libraries offer an opportunity for residents to rent a bike for a longer period of time, whether that's days or weeks, rather than just say a ride on something like a bike share system. And this can really offer an option to test out what ownership would be like before committing, so that try before you buy. And this can really compliment the voucher programs as well. So you can test out what it would be like to have life with an e-bike and then sort of work up to purchasing an e-bike with one of the voucher programs.

In addition, you mentioned the East Bay Community Energy Lending program. The city of Richmond, California also received grant funding for an e-bike lending library. So there's definitely a lot of these lending programs popping up. I don't think we've mentioned this one yet on this panel, but CARB, the California Air Resource Board should be launching their

statewide e-bike rebate program soon, and that one is equity focused, so capped at about 300% of Federal poverty level. So we're seeing more and more of these complimentary programs around the Bay, which is really exciting.

And yeah, I think holistically, what's great about these programs is you can attract people to e-biking from a variety of different angles. Maybe first you get the first taste of an e-bike through Bay Wheels or another micromobility provider, then taking a longer rental with the e-bike lending library and then working your way up to purchasing one through the rebate program. So I think this holistic approach can definitely make e-bikes more of an option, not just for high income individuals, but just for everyday people who are looking for mobility options to fit their needs.

Dianne Martinez, Garfield Foundation: I think you are a hundred percent right. And one thing that is extremely exciting is the potential for people to change modalities once they try an e-bike. So when we have all of these incentives to switch over for light duty, medium and heavy duty vehicles to switch over, that's not changing a modality. That's just changing the actual vehicle itself. The anecdotal evidence and feedback that I get from community members when they move over to e-bikes is that they are ditching their cars, that they're going further than they would go on an analog bike, that there are lifestyle changes that benefit their health and their communities and it makes them more active community members when they're speaking up for things like protected bike lanes next to schools. So there are a whole slew of benefits that make me really, really appreciate the lending model and introducing a new concept to people that might look familiar because it might just look like a bike, but it's going to get you a lot further.

And I'll tell you, when I moved from Los Angeles to the Bay Area and I took my bike onto post street in San Francisco to get to the dentist, I didn't read the elevation map and it was real sad and very sweaty by the time I got to my appointment. So I'm very excited for a whole new world of opportunity of people being able to experiment and push the limits of being in such a joyful mode of transportation. So thank you so much, Laura, for that input.

We haven't had a chance to talk to Ruben yet from Better World Group. So my question is for you next, Ruben. Welcome. E-bikes and e-scooters actually have the ability to increase access to economic opportunity, but without strategic planning, these modes of transportation are not always accessible to everyone. So how does setting clear equity goals and measuring against these goals make these programs more equitable?

Ruben Aronin, Better World Group: Thanks, Dianne, and thanks so much for the opportunity to join you all. I'm excited about thinking about e-bikes and the gateway drug of e-bikes in enhancing transportation capabilities, especially for some of our neediest communities who we're not talking about shifting modalities, we're actually talking about transformative technology deployment that can meet transportation deserts for folks that need to get to

everything from jobs to school to work and errands that are really hardships to do right now. But as you mentioned, setting equity goals is critical and equally critical is the need to have an equity process at the heart of e-bike and other micromobility deployment strategies. And by that I mean ensuring that communities are engaged from the beginning of program design to identify their particular needs and opportunities, and it's important for communities to understand the capabilities and use cases for micromobility solutions to meet their needs.

As for important metrics to consider, ways to ensure that programs can be affordable, economically viable for users, sustainable and ongoing, and can be incorporated into sustainable transportation solutions that might connect them to mass transit or other transportation solutions. Making sure apps are in Spanish as well as English and can be easily used, and that there are solutions for unbanked community members who may not have access to credit cards or ATMs. By evaluating the needs of communities and engaging with those communities, many of whom have identified transportation gaps and priorities, solutions can be customized to ensure success and that the community needs are met.

For example, one recently launched e-bike pilot lending library near the San Pedro port in LA that was spearheaded by the housing authority of the city of LA and the LA Cleantech Incubator, they revised their plan to include the deployment of e-cargo bikes that dramatically expanded the use cases of not just moving people but moving their groceries or goods or even young kids.

And it's seen a real balloon of use of that program. They also were able to raise the dollars to have a community ombudsman who helps operate that program, a college student onsite who's a champion and proselytizer of the program as well. Too often our community sees zero emission transportation solutions as trickle down ones. Eventually costs will come down. Eventually EV infrastructure deployment will happen and the used market will take over.

We can flip that model with micromobility and actually look at an abundance model where we can deploy rapidly micromobility solutions while the EV charging for vehicles will take a little longer, for example, to happen in multifamily spaces. Just to getting back to your question, setting realistic, clear, equity goals and ensuring there's an equity process at the heart of getting to those goals is really critical to meet communities where they're at and to be able to design and deploy strategic e-bike and other micromobility solutions to make them a reality.

Dianne Martinez, Garfield Foundation: Ruben, everything you said, I agree with. So much of the Green Revolution has put people of privilege in first place and that includes with electric cars, people having the ability to install solar on their homes. But what if we shifted the paradigm and put those frontline and underserved communities first? I just think that is what we should all be considering and I'm proud to be in an ecosystem where we are using those metrics and filters to understand what it looks like when we prioritize these communities. And the last panel, the representative from CARB was talking about CalEnviroScreen, and I have lived in

underserved communities for my whole life except for a magical 18 months when I got to rent a unit in the hills, but I couldn't continue to afford that. But I feel like that on the ground level, that is where you are going to see the most benefit. And I have to out myself that I own an e-scooter, and I'm one of those people who, that is one of my favorite modes of transportation for getting to local meetings and such. And yeah, it couldn't be better with the wind in my hair and not a beat of sweat dripping down me as well.

But we're going to move on. Thank you so much Ruben, for that very thoughtful answer. We're going to go back to Julia and we're going to change the topic to charging. Julia, your team has done a lot of research around how charging networks can support the electrification of all modes of mobility. Can you talk to us about how that research went and what state and federal governments can do to support in the way of policy and funding for chargers? And I know there's a lot in the news lately to kind of filter through in terms of funding, but how should we focus this?

Julia Thayne, Rocky Mountain Institute: Yeah, I mean, it's a great question, Mayor Martinez. And a lot of what Ruben was saying too around the phasing and the rollout of charging infrastructure or bike lane infrastructure or even how we have e-bikes potentially before EVs is something that really resonated with me as well. I want to make two main points here, and one is around the implications on urban design and safety. And the second is really around broadening the definition of infrastructure.

So Rocky Mountain Institute has done a bunch of research on charging networks for passenger vehicles, for heavy duty transport, for everything that the federal government right now is spending a lot of money on in terms of setting up charging infrastructure in and across the country. One of the things that we talk about a lot at RMI is how charging networks cannot be electric gas stations, but instead be something new and different that has better implications on both urban design and safety. We're trying to avoid electric gas stations in terms of, I mean, if you all live in cities, you know how hard it is to be a pedestrian or a cyclist navigating around a corner where cars are coming in and out, and trying to figure out how you manage and maintain your own safety while all of that is happening.

So we have talked about how we could have more charging hubs and something that's better and different and multimodal when you're talking about electric transit, electric trucks, electric cars, electric bikes and more. So that's one main point. The second main point is around broadening the definition of infrastructure. What bothers me when talk about charging networks is that we often talk about charging networks as if it was only the chargers themselves, but really, when we're talking about being supportive of electric mobility or electric transportation, we have to be talking about the chargers themselves, we have to be talking about battery swapping stations, we have to be talking about, especially for micromobility, secure micromobility storage.

And we are not doing that in the US right now. Places like Delhi in India are, and they have actually vaster or wider, vaster, I don't know if vaster is a word, but we're going to go with it. They have vaster infrastructure in terms of charging and battery swapping stations and secure micromobility storage than we do. So I think state and federal governments have all of this money that's coming through the Infrastructure Investment and Jobs Act. They have all of this money that's coming through the Inflation Reduction Act. They have even more money that we're going to have in the future.

And so being able to program those dollars so that you have safe, desirable, well-designed charging hubs, and thinking about those charging hubs as encompassing much more than just a charger or an electric gas pump, to battery swapping stations, to secure micromobility storage, that's really how we're going to start to move the needle around electrification of all modes of mobility rather, including micromobility.

Dianne Martinez, Garfield Foundation: Wow, you're giving me all kinds of ideas about how new schools of urban planning need to get funded that would accommodate for all of the electric infrastructure. Not only the new electric infrastructure that we will be producing from sources of renewable energy, offshore winds coming to California sometime in the next 10 years, those are going to meet huge cables getting into our cities. But how do we build our cities to account for all of the charging infrastructure?

And I'm so glad that you mentioned that there are pain points for bikes and pedestrians and other drivers when you create infrastructure that replicates what we've got in the past, which is a gas station. Let's take all the good parts of the gas station and leave the bad parts behind. I love that. Next question is going to bring it back to Tejus. Let's see if I mess this up. TechCrunch lovingly calls Lyft the quiet cultivator of hearty docked e-bike share ridership. But we've heard that soon you're launching dockable charging stations called Pillars, while today's vehicles are built with a swappable batteries. So do you think there's space for both models in the future? Which way is the needle going to tip?

Tejus Shankar, Lyft: Yeah, it's a great question. And I think what's really cool about them, there is space for both, but I think what our goal with our station network is to minimize the need for swappable batteries in the future. So our vehicles all do have swappable batteries and will continue to have swappable batteries, but what we're looking at with Pillar is how do we actually create this new station designed for the user experience and to improve operational efficiencies of the system by actually bringing in charging into the station itself.

So actually talking about, I know Julia mentioned a lot of funding opportunities and Gabe as well around the community, the CFI program and the community charging program. And we really see this as there's been a lot of focus on electrification of vehicles, but how do we actually think about, the hardest part is actually getting the connection to the grid. So if we are able to harness that, can we use that for other use cases like powering shared micromobility?

And so what's really cool about Pillar is that we have integrated charging into the station itself, and with that, we're able to actually charge our latest e-bikes and scooter models directly in the dock. So it's a really cool way to be able to actually have deployment of our vehicles and fully charged vehicles at all times for riders. Through Pillar, we're actually going to be able to really deploy this across all of our markets with the angle of not every station actually needs to be electrified. So if we actually look at, we've built some models around this and found that if we just electrified 10% of our station, 10% to 20% of our stations, we're able to gain operational improvements around 90%. That's because of the way that the bikes are floating around the city and how people are using bikes and scooters and their patterns.

So that's one really cool aspect of it is we're talking about the multifamily use cases and ways to grow ridership. This is one way to actually cultivate that since we're able to target specific areas to ensure that all of our devices are fully charged. And that's where also partnerships with cities is really important. So as we're thinking about this further, we've been able to test this actually in Chicago and we have electrified stations in our Chicago digging network. It has been a great opportunity to see what that can look like for both bikes and scooters.

And what we found is in deployment of this, partnerships with cities and partnerships with utilities are critical to actually enable this process to happen, and we really see that as a go forward solution to making sure that we can do that. And in terms of swappable batteries, I think there is still a case where we can actually consider swappable batteries in lower density use cases, but when we actually create this network, I think the value is that we would reduce the overall need to swap batteries if we can gain those operational efficiencies through Pillar.

Dianne Martinez, Garfield Foundation: I really am coming to appreciate how quickly you guys can pivot, and as I mentioned before, use that real time data to just create extreme efficiency. And we see the results of that so quickly, and I know that my city is one of the ones that benefits from your micromobility strategies. So I'm excited to see how things move in the future.

Next up we're going to bring a question back to Laura at MTC. We're excited about the advantages of e-micromobility, but it's impossible to improve conditions for our residents if we don't honestly talk about the challenges that lay ahead. How do we address them, iterate our programs and provide solutions that actually get used? Can you tell us a time, an instance when your team identified a challenge and what were your strategies to overcome those challenges?

Laura Krull, Metropolitan Transportation Commission: Yeah, great question. Yeah, something recently that we've been looking at is survey data from some of the local agencies who have already launched their e-bike rebate programs to understand more about what the barriers are for participants to actually use their e-bikes. Purchasing may seem like the biggest hurdle, but there's still a lot of the downstream factors than we aren't necessarily sort of upfront

considering in getting individuals to actually bike on the e-bikes. So the two biggest barriers we heard in these surveys from participants were safe cycling infrastructure and secure bike parking, which thank you Julia for sort of teeing me up for that one.

And as we've sort of all kind of mentioned already, cycling infrastructure is a well-known barrier to biking, whether it's e-bikes or not. And it's also something well documented in research and is a piece that cities, counties and other agencies are diligently working on. Secure bike parking is less discussed. It's sort of a newer, well, always an issue with biking, just sort of less discussed. So with e-bikes, it's important to remember that one, they're a lot heavier than a regular bike. And two, given that they're more expensive, you just have to be a little more thoughtful about parking than with a regular bike.

And I mentioned the weight because a lot of the housing stock in the Bay Area, especially for income qualified participants in many of the voucher programs are not necessarily single story homes or homes with a garage. So that may mean that you have to haul a bike up two flights of stairs to get it inside to a secure location, which isn't feasible for most people given the e-bikes range on average from 30 to 80 pounds, but power to anyone that can feasibly carry that up many flights of stairs.

So, what we've seen, many transit agencies are already thinking about this, especially at major transit hub since users are leaving their bikes for a longer period of time. In the Bay Area, for example, BART has booked at a number of stations with bike lockers, Caltrain and some of the BART stations also have bike valets where you store your bike inside a storefront. So looking at how we can expand these secure bike parking options to a wider net of destinations could go a long way to increase usage. So that could be bike lockers, secure bike rooms, other parking options both at home, whether that's in an actual residential neighborhood or in your physical home, or in apartment buildings. I think those pieces could really help adoption in usage. So I think we definitely have a lot of work to do in sort of understanding the needs, and then figuring out how we can provide those facilities accordingly.

Dianne Martinez, Garfield Foundation: I think that's great, and if there are any public policy makers listening in the audience today, I know that from my experience on a local city council, that has become increasingly more important to have these considerations about these larger bikes, cargo bikes, and accommodate for the fact that people will need to get them upstairs, get them into elevators, get them into secure parking. And as we continue to, like I had mentioned earlier, stop thinking about these issues in different silos as we think about housing, VMT, and micromobility as a different modality for transportation, we need to, where are we going to park these bikes? Where are we going to charge them? And how do we create that safe infrastructure in our cities and interconnected between our cities to help people make those shifts?

We've got one last question. Thanks everyone for hanging in with us. We are almost done, but I do want to give Ruben one more chance to share his vast knowledge. I want to take a moment

to point our panel toward their thought leadership and ensuring that e-micromobility solutions are made accessible and equitable for all. And, oh, am I, oh sorry, I want to make sure that I'm on the right question. I apologize.

Oh, I've got a couple more questions if we've got time, but we're going to start this one with Ruben. So can you talk to us about strategies that make micromobility programs and products more available to those of different abilities, backgrounds, and income levels?

Ruben Aronin, Better World Group: Sure, thanks Dianne, and thanks for the robust conversation. As I mentioned earlier, the first step is to engage with communities that really want to help solve their mobility challenges. Especially at a time when traditional transit operations are being threatened with reductions and the prices of new and used cars are getting more and more out of reach for many Americans, many African American and Latino communities don't know many people in their community who bicycle at all, and some think that it's not for them. Or in other places like Santa Ana, bicycle commuting is a way of life, but only for those who are really in good shape and capable of riding long distances. Other residents think it's not a solution for them.

E-bikes really offers a new mobility solution with further range, quicker commute times than traditional bikes, and there's an opportunity to engage with diverse communities to educate them about the opportunities. Additionally, before going about deployment, it's important as many of you have mentioned, to evaluate the safety and applicability of accessible and safe streets in communities to make sure that people are protected ideally in bike paths, and that there's appropriate signage and really safe corridors.

Too often, technology companies, well-meaning cities, transit agencies or nonprofit groups, start with the technology solution and don't evaluate what's needed to ensure the success of those kinds of programs with safe communities. Additionally, I really love the lending library gateway drug, and identifying with a community, library, schools, churches, businesses that would be ideal participants so that communities can begin to see people using this and get first adopters. We also really need to make sure that this isn't yet another gentrification signal to communities, and that these solutions can be optimized and scaled for communities to meet the needs that they've got.

We also need to devise sustainable operations models to ensure that pilot programs from government or philanthropy aren't standing up programs only to let communities down at the end of the funding phase. We need to find ways to eliminate financial barriers, including what I'm learning are the high cost of insurance premiums for e-bikes. Might be another role for government or other insurance products to buy down an unanticipated cost for program deployments.

In wealthier communities, the goal has often been this mode shift, to get people out of cars and into micromobility solutions. We need to acknowledge that low income communities

need enhanced transportation services, and micromobility options can really provide a critical lifeline to services that community members need. And we need to celebrate the successes of deployment and tell those stories so that communities will want this. And the exciting thing from a price point perspective, at a time when we're investing billions, right, in EV infrastructure solutions for cars and trucks, the level of investment is much more modest, but actually can be much more transformative for transportation access that we can provide to communities. So thanks for letting me clean up on this one and hopefully that's helpful perspective.

Dianne Martinez, Garfield Foundation: It's beautiful and I think you really were able to let us know what the low-hanging fruit is. So much impact can be made for a fraction of the investment that we're putting into other areas of electrification. And we've got time for one more question and this is going to go to Tejus. Lyft's 2022 report shows that micromobility rides in low-income areas increased a stunning 65% in 2020, and part of that's due to the expansion of programs like CitiBike and Divvy Systems.

Can you talk to us about how expanding your partnerships and programs improves equitable access to e-micromobility solutions? And while you're thinking of that answer, I'm going to ask Laura, because I can't get to you next, but I'd love for you to share a link in the webinar chat for the e-bike program that you folks at MTC are promoting. And take it away, Tejus, to round us out for the day.

Tejus Shankar, Lyft: Yeah, thank you so much Mayor Martinez, and completely agree with everything that Ruben said too. I think there is, if we focus on supporting our community partners, there's a really strong way that we can actually grow the most equitable systems going forward. So that's definitely been an area that we're focused on here at Lyft. We really work closely with our community partners, city partners and local advocacy groups to support low-income riders. One example of that is our partnership with Equiticity in Chicago, and as you mentioned, the growth of the Divvy System. That's been a big part of that. They support transportation justice on the south and west sides of Chicago, and so working with them has been really valuable and to help to create that shift.

But just so I wanted to give a sense of who some of our low income and equity program riders are. So we do have discounted program memberships for many of our riders in various cities, and we've actually surveyed our riders to get a better sense of who they are and published this in our Lyft's multimodal report. We found that our equity members take actually 54% more rides than other members. They're 28% more likely to be women, 26% less likely to own a vehicle, and we're really seeing huge e-bike ridership as well.

And so to Ruben's point, I think a huge part of this is a lot of our low income riders are really seeing e-bikes as a car replacement tool, especially given the lower rates of car ownership in these communities. So our equity programs have seen tremendous growth, and we're really

excited about how we can use shared micromobility as an opportunity to grow ridership. But the programs do come at a cost, and we think more needs to be done from cities to support cycling and to support cycling in lower income communities.

But the first aspect of it is a lot of American cities have made great strides in developing protected bike networks, but they're often, they're lacking in the same way in lower income communities. And so building out that protected network is really vital. And then also, we think about the amount of public subsidy that's been poured into car infrastructure. It's far greater than what we're seeing in bikes and scooters, and I know we've had a lot of discussion about that in this panel. And so what we really want to see is can we grow public investments in our systems and in our equity rider programs to support our riders?

One anecdotal I'll leave with is actually in Portland, our Biketown program does have, the city actually supports the equity program and we've seen tremendous growth in ridership of the equity program. It accounts for the majority of the rides in the system, and overall, we've seen actually the demographic shifts in the program, ridership overall to be more supportive of lower income and minority populations than we've seen really in any other network. So we're really excited about the opportunities like that and ways that we can support the growth of e-micromobility solutions for lower income communities.

Dianne Martinez, Garfield Foundation: Thank you so much, Tejus. And I just want, I'm going to drop one last bomb in here and that's that, and lift up something that you said, which is that when women make these modality shifts, whole families and communities come along. And that's my wisdom for the day. Thank you everyone.

Josh Boone, Veloz: Thank you Dianne, thank you to the entire panel for the incredibly insightful discussion. I have to confess, I often steal my son's e-scooter when I'm running an errand down the street. So I was keenly interested in listening in on this topic. But thank you all very much for your time and your expertise.

Well, everyone, we made it to the end of the summit. It's been an exciting day filled with aspirational and inspirational content and speaker, so allow me to share a few key takeaways before we adjourn.

Going back to Gabe Klein's keynote, he mentioned that America is reinventing how it moves people and goods and how we power our economy with renewable energy. And this is an effort that is one of the most important missions that we could collectively work on in our world today. He also noted that one of the jobs of the Joint Office is to be the front door to the federal government for anyone wishing to engage on transportation electrification. There are $7.5 billion in funding programs, there are newsletters, there are technical support, and engagement and education programs can all be found on their website at driveelectric.gov.

I also want to highlight the three points that our community partner spotlight speaker Colleen Quinn made, thought they were really important. One is policy leadership matters. Two,

ongoing collaboration matters. We're doing that today. And three, business models matter. And we know many attending today's summit are moving all three of these topics forward, and we thank you for that. Across the board, manufacturers, regulators, government agencies and charging providers and many other organizations are all poised to deliver electrified solutions. Whether in electric vertical takeoff and landing, traveling urban air corridors at zero emission vehicles at seaports, or e-bikes or scooters on city streets. As EV industry experts, we can be powerful advocates in bringing electric school buses to our nation's children, the next generation, and to often vulnerable to poor air quality.

And finally, the broader EV market that we discussed today really does have the best and brightest minds involved. The more we expose ourselves to other forms of transportation electrification, projects, companies, professionals, and the more we center equity in transportation electrification, the more synergy there will be in delivering a holistic, clean transportation ecosystem in the nation.

Today's summit would not be possible without the thought leadership and hard work by all the folks you saw on the screen and the many more that were behind the scenes. I want to start by thanking our community partners who this year brought in many new folks to our Veloz platform. For those of you who did come to our audience today via one of our partners, I hope you enjoyed today's content and that we'll see you again real soon. A special shout out to the National EV Charging Initiative as our spotlight partner this year.

Veloz industry events, among many of our other programs, are generously funded by our broad membership. We could not put on this type of content that we did today without their expertise, their guidance, and their support of our organization. For those of you who are new to the Veloz ecosystem, we encourage you to reach out to us or even follow our social channels, join our newsletter so you can learn more about Veloz and its broad array of members. Our team will put be putting on EV events like this all year and will be at conferences that you're going to. Visit our events page to register for our upcoming events and come find us at Forth Roadmap Conference in Portland, and the international EVS36 conference in Sacramento. I believe that's coming up in June.

Please subscribe to the Veloz e-newsletter for upcoming events, and of course, our quarterly EV market report. This year, we've added medium and heavy duty trucks, buses, and delivery vans and collaboration with the California Energy Commission so that we're all tracking the overall ecosystem together. You can share your thoughts, your takeaways, and your favorite moments via our social media channels that you can see here on the screen.

And finally, summits like this one take many people working on all the moving parts. I want to start by especially thanking the team over at the Joint Office and Gabe, of course, for providing a keynote address while running billions of dollars of programs. Thank you to all of our panelists, our moderators, their support teams for bringing your subject matter expertise and inspirational content to our audience today. A special and warm shout out to my colleague,

Munni Krishna and Shevonne Sua for envisioning today's summit and executing with perfection.

My final thank you today is to everyone in our audience, whether you're new to Veloz or whether you're a longtime supporter. Most of us dedicate our careers to transportation electrification, and we know that we would not be anywhere near close to our nation's ambitious goals without you. For anyone interested, a post-event survey will pop up when you close Zoom. We pay close attention to your comments such as bringing in summit elements and topics that you have recommended, so know that we are truly reacting and listening to your feedback.

On that note, I want to wish you all a very successful and prosperous and happy spring, and we look forward to seeing you all again real soon. Thank you and goodbye.