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COMMISSIONER WORKSHOP ON PLUG-IN ELECTRIC VEHICLES CHARGING INFRASTRUCTURE

REMOTE VIA ZOOM

SESSION 2: TUESDAY, AUGUST 4, 2020

2:30 P.M.

Reported by:

Martha Nelson

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AGENDA

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P R O C E E D I N G S

2:30 P.M.

TUESDAY, AUGUST 4, 2020

MS. RAITT: Good afternoon. Welcome to today's 2020 IERP Update Commissioner Workshop on Plug-in Electric Vehicle Charging Infrastructure. I'm Heather Raitt, the Program Manager for the Integrated Energy Policy Report, or we call it hyper for short.

Today's workshop is being held remotely consistent with Executive Orders N-2520 and N-2920 and the recommendations from the California Department of Public Health to encourage physical distancing to slow the spread of COVID-19.

As part of our efforts to encourage participation, we're holding this workshop in four shorter sessions over two days. So this afternoon is on charging infrastructure technology and markets. And the workshop will continue on Thursday with Sessions 3, starting at 10:00, and Session 4 at 2:30.

This meeting is being recorded. We'll post the recording and written transcript on our website. Also, today's presentations are already on our website, if you want to refer to them

there.

And if you joined the meeting this morning, this afternoon will be a little bit different. We'll be having a series of presentations, rather than a panel discussion, and, unfortunately, we will not have time to take questions from the audience. As always, however, attendees do have the opportunity to provide comments on the material in today's workshop, and there'll be an opportunity for a couple of comments at the end of this, and each of the sessions.

So for those on Zoom on-line, click the raised hand icon to let us know you'd like to make a comment. And for those on the phone, press star nine to raise your hand, then we'll open your line during the public comment period.

Alternatively, written comments are welcome after the workshop, and they are due on August 27th, and the notice gives you all the information you need to submit those written comments.

And with that I'll turn it over to Commissioner Patty Monaghan for opening remarks.

COMMISSIONER MONAHAN: Well, good afternoon everybody.

And, Heather, is there anybody else on the virtual Dais, or is it just me right now?

MS. RAITT: I'll double check. I think it's just you though.

COMMISSIONER MONAHAN: Okay, thank you.

Well, thanks to Heather into the whole EIPR team. I feel like in a world of COVID we've done remarkably well transitioning away from our in-person meetings in Sacramento towards this virtual format, and even finding I think some advantages to being able to meet with everybody across not just the state of California, but we've had international participants as well in IEPR process that we would have had a hard time getting in person in Sacramento. So there is a tiny little silver lining to all the challenges that we are facing.

So, for the rest of this series, we're going to be focusing on really deeply exploring charging infrastructure, including the charging infrastructure needs to meet California's goal of having 5,000,000 electric vehicles on the road by 2030. And that this is an issue near and dear to my heart as an Energy Commissioner. The Energy Commission, as I think everyone knows, is

responsible for building out both electric vehicle -- battery electric vehicle charging infrastructure and hydrogen fuel cell charging -- hydrogen fuel infrastructure. So, we care deeply to make sure that we are doing this right in a way that benefits all Californians.

So, I want to just quickly turn to the presenters today and introduce our first speaker this afternoon. It's Paul Francis, who is the CEO and Founder of KIGT, K-I-G-T, which I don't know what it stands for. So, Paul, I hope you first tell us what it stands for.

So KIGT manufacturers smart charging stations for electric vehicles. And since starting to do it in 2009, Paul is connected several electric vehicle pilot charging projects with municipalities, including a vehicle-to-grid demonstration project at the Port of Long Beach and another at Port of Los Angeles.

So he most recently facilitated and instructed the first ever electric vehicle network technician training program in partnership with the Los Angeles Clean Tech Incubator. And the L.A. Clean Tech Incubator is one of the leaders across the country in terms of

setting very, very ambitious goal for transportation electrification in the L.A. region in advance of the Olympics that are coming up in -- what is it, 2028, is that, Paul? Something like that.

Anyway, I turn it over to you. I 'm going to go off video right now and pass the baton to you.

MR. FRANCIS: Thank you, Commissioner. I'm unsure with the Olympics with everything being postponed in Japan. I don't know the logistics of that anymore. Hopefully we get an update soon.

But, thank you everyone for joining amidst everything, taking the time out to be in on Zoom. I'm looking at yet another on-line presentation. We appreciate that.

So I KIGT just to give a little insight. It stands for Keep It Green Transit, Keep It Green Tag and Keep It Green Team.

And so today in the presentation we're going to discuss our mission and model of reshaping 100 years of human habit. And on the next slide, you'll see, we're going to tell you a few stories. First about our friend named

Preisha (phonetic). Preisha a young girl who has to do homework underneath streetlights because she has no power in her home.

And on the next slide you're going to see a story of a family named Stacy, who right now during shelter in place on has to work with her child when school comes back home.

Many of you, like myself, we have kids, and we're dealing with that currently, and how EV's can positively maybe impact that in the future.

And then the next we're going to ask you guys to use your imagination a little bit and discuss how billions of people will have access to EV's in the future globally, and how many of them, like on the next slide, is of our friend Eve. Right. Eve is not just a fictitious character. Eve represents the 5,000,000 additional people the State of California is expecting to drive EV's over the next 10 years, right. Eve represents KIGT's customer base. When we talked about the University of Laverne parking manager, Lisa Grater (phonetic), or the VP of purchasing of the multi-family developer at Lewis Homes. And seeing Eve really as the site

host who has to decide, like many decision-makers in California, whether or not they're going to get charging stations and what benefits, what are the amenities, and what are some of the pain points that come with that.

When you're talking about multi-family, the State of California has a vast amount of people who rent. Right now we have stats that's a 55-percent of households in California are renters, and that's a large, vast majority of people were expecting as a State to adopt EV's.

So one thing she asked to keep in mind is, not only is she looking for an EV for herself, like many of our customers and many of yours out there who are OEM manufacturers, she has to think about those who she lives with and those that are tenants and live in the community.

So on the next slide you see what we've done at KIGT was created easy-to-use charging stations. This image here is at Lewis Management property at a multi-family complex in San Bernardino County.

In Rancho Cucamonga, it's a block away from our offices in Ontario, which happened to be a disadvantaged community. And so with that,

what you're seeing is -- excuse me (clearing throat), she has major issues. It's not just getting a charger. The number-one issue, as we can Harrison, we're doing some cool things -- I kind of got ahead of myself. But we're going to ask you guys to oblige and participate in a quick poll.

Can we do the first one about Eve, Harrison?

Right. So I'm going to ask everyone, 20 seconds to answer. In our experience at KIGT, what's the number one issue that we're coming up with when we're talking to property managers and site homes? Is it network fees? Is it the hardware costs of the charger, the installation costs? Is it simply getting help, right, once they're installed, how do you help us? And is it just making money in the revenue?

About another 10 seconds, please.

Four, three, two, one. Close poll.

All right. Surprisingly enough, we're seeing that hardware install costs we often think would be the number one concern, but when we're talking to customers and doing discovery, it's actually help. It's help, and it's making it

easier to use for customers.

Please move to the next slide.

In our other video we have we show how -- one thing we like that the State of California has done, others of our counterparts are on the fence in, is that they've made credit card swipe an onboard EMV a necessity, a mandate. And that offers the nostalgia feeling we all have from gas stations.

I mean, imagine a simple fact that all of us who have droven -- driven a nice vehicle in the past, if Mobil or Shell said, you have to have a network membership to fuel up and use gasoline, we wouldn't like that. Often, there would probably be some pushback. But, unfortunately, in the world of EV's, that's the case.

So BTC, a hardware manufacturer like KIGT, we manufacture our own hardware, we've added that component standard with our charging stations.

Next slide.

One thing that matters when you're talking about EV's and property owners, because aesthetics is important. When you're looking at

properties, and architects they're putting this effort to designing a beautiful California with these new multi-family developments in these new housing developments. And so charging also has to look appealing.

And so one thing we pay attention to and we really are concerned with -- next slide -- is the user friendliness. And with that, with the credit card swipe, and one of our key components, and we believe is smart charging we'll discuss a little bit later, we've allowed it for folks to charge for free. And we believe this is a model that can be scaled to help with the millions of EV adopters coming on-line soon.

Next slide.

Right. So when you talk about billions of people having access to EV's, we're talking about globally. Unfortunately, when you look at people who buy vehicles in the State of California and you compare them to numbers globally, about 55-percent of people say they rent. They don't -- they buy used vehicles. But yet we're expecting new automakers to have really exciting, cool EV's that go extremely far, to rely on us to have this mass adoption. Whereas a

lot of folks, especially in California's disadvantaged communities, are unbanked. They don't have access or the means to buy these new EV's. So what are they going to turn to? The pre-owned market.

Next slide, please.

And we believe user experience is important and that's why we really harp on free charging. To be a member of many of the networks, often you have to have a bank account. And many folks, about 7.5 people that live in poverty, of that 7.4 million -- 7.4-percent of people in California are unbanked. So how are we going to expect mass adoption when millions of people simply don't have bank accounts to join EV networks?

So at KIGT, we decided that free charging for those who are income eligible, those who happen to have TAP or EBT cards, can charge for free in disadvantaged communities to add incentive.

And -- next slide, please -- the user experience matters. Smaller smarter, faster, just like our cell phones, just like our mobile phones as you guys know, are absolutely critical.

Next slide.

And so one program we have using the rebate programs the State of California has, and the wonderful incentives the utilities have, like the IOU's, one example is the Replacement Your Ride Program.

We've helped customers through our program, KIGT Cares, go through the installation process, help them with the rebate, help them with the homework. Help them understand if they need an additional electrical panel, help them understand that they need a new meter, because these are many of the barriers that we're facing day to day on a grassroots level that kind of hindered the adoption.

In addition to that is price. So when you look at the price of hardware, when you look at the cost of installation, especially some in DAC communities, where you have detached garages and trenching, and you may not have the panel necessary, thousands of dollars. And if we're wanting millions of people in all of California to adopt EVs, we have to make it low. So we offer it that $99 out of pocket for income-eligible families and households.

Next slide.

And one thing we're extremely mindful of is at our private projects, especially in DAC communities like the South L.A. church project with Victory Baptist, or the church project we're doing at Memorial McCarty in South L.A., our commercial charging stations, the Slim, when you talk about user experience and you talk about software, has the capability to charge portable to 220 volt charging stations.

At KIGT we manufacture 30 amp, 220 volt home and commercial charging station network. We've done that so it makes the pain points easier to -- for barrier of entry for everyone.

Next slide.

And for a low cost for those who wants smarts and intelligence, what we're making sure of is to do cool things like, Alexa, charge my car. Our hardware also has the capacity to throttle power in real-time, to mitigate demand response times and events, so that we can add grid resilience. And to do that we add the smart screen, so that people have that Nest feel, because a lot of families, like my mom and people like Eve who want to adopt a new EV, don't want

to download another app. And sometimes you lose storage. That really happens.

And so with Nest feel inside the home for consumer charging stations, for Eve who receives rebates for her multi-family development now through Edison's rebate programs, to install consumer charging stations at each development.

Now you can upgrade with the smart screen. We have intelligence without additional electrical costs, and we feel that's a very good barrier to entry to help integrate with utility and add grid resiliency cross the board.

Next slide.

And that KIGT, we're very promising. We manufacturing 100-percent in California. We do that as a reason for, to reduce costs in the Inland Empire. It's extremely important, and we're beneficial of the logistics of having Ontario International Airport with FedEx and UPS. Having hubs here so that we can transport, so that we can manufacture up to 4,000 units a month in our manufacturing facility. And with the uptick in supporting 5,000,000 of EV's, and that ratio of charging EV's, we're very hopeful that with the programs in place, that KIGT we can

scale in higher, especially when you talk about metal fabrication, PCB boards, painting. We do everything in Southern California along the 91 Freeway, and in the Inland Empire from O.C. to San Bernardino County.

Next slide.

We do have a poll question. Here's just a quick image of our Level 2 Plus. We know charging is important to people who want to buy EV's. And our next poll question and our next slide kind of alludes to what we're doing in the future.

Next.

So our team at KIGT has designed a program, a technology that is V2G capable as well.

Next slide.

And one thing we've done at KIGT is we've offered internships to STEM growth and job development and workforce development in our communities. This is one with the high schools in 2014.

Next slide.

Additionally, this is the first ever event training. A third of these participants

were recently incarcerated, many of them from Southern California in the L.A. County area.

Next slide.

Here they learn how to fix charging stations. One dirty little secret we have as EV manufacturers, that 20, 30-percent of charging stations in the field are inoperable. These folks will learn 30 to 50 to $75 an hour going out and repairing these charging stations.

Next slide.

And we're very proud to say with Lacey (phonetic) we've continued this program, showing them hands-on training. This was COHORT1.

And in the next slide you'll see a picture of all of us and our most recent COHORT, doing distance training, where they're learning all the skills and they're giving presentations this Friday with Lacey on demos.

Next slide.

Here's the success story of Desiree. I'm running a little bit out of time, so I'll talk about her another day.

Next slide, please.

And our most recent projects where you'll see what we're relying, on LCF credits when we're

looking at free charging sessions, is something we're infusing with our charge cloud software in our network, because we think free charging with the different incentive programs, with low-carbon field credits, with power thwarting capability through load shaving demand response programs, and KIGT chargers have the ability to have digital advertisements on them, because property owners like you want to earn additional money.

Next slide.

And so we talked about smart charging, one thing we've demonstrated with the State of California is -- and one of the grants we received is how we can throttle power in real time during demand response moments, so that we can add more grid resiliency. So that people can charge less, so that it will cost them less to charge there.

Next slide.

And so that during COVID moments, if you have an EV, this picture here is showing our PMO, our project manager Brandon, actually demonstrating this at UC Riverside being COVID safe.

Next slide.

We're very grateful to receive a state grant to work with UC Riverside to further develop this technology, so that we can create a price surging program around demand response, where customers can choose premium or unleaded like at the gas station. Do you want to charge a full power in real-time or less power and pay a different rate? We think that'll really help adoption and kind of skew that price point when you're talking about communities that can't afford charging.

Next slide.

And V2G, right, back to our friend Preisha. As you see in this picture, what we truly believe is that when you use your imagination, you look at the possibility of how you can charge your car and have a full tank from your home at an affordable rate, then when you can go to work and have people knowing that they can fix the car and they'll charge the car, and you still leave with a full tank, and then you move on and you get home and you go power your home, right.

Power your home with electricity. So you have access to Wi-Fi and access to information

like, Google, that help KIGT get started.

Next slide.

And we believe together, helping people have early adopt -- having -- we believe together that working with everyone in the State of California, with these incentive programs, with the state grants, technology, innovation, making it easier for people to charge, make it more affordable for those at disadvantaged communities, making it smaller so the footprint is easier to put into your home, all these things matter.

And one thing that you notice in this presentation, we didn't have one picture of an EV. And the reason is, to save the world is a human endeavor, not a technological window. And we really believe, as humans, we have the ability to solve this problem and reshape 100 years of human habit.

Thank you.

COMMISSIONER MONAHAN: All I can say is, wow. That was a terrific presentation, Paul. I didn't see the survey results. What are we going to show them up there?

MR. FRANCIS: Yeah. I didn't get to go

through all of them, unfortunately, but we did have some cool polls. I think it would have worked out well. I have to wrap up on that.

This one poll right here for V2G, back when we've done our demonstrations, we did the research. And we found out that 722 Nissan LEAF's at half capacity can actually power 1,000 homes.

COMMISSIONER MONAHAN: That's amazing. I'm curious. I mean, KIGT is so much more than a classic electric vehicle charging company. Tell me more about how you -- your origin story and how you came to focus on making sure that everybody benefits, not just rich people from this transition?

MR. FRANCIS: Yeah. So always been an entrepreneur right out of college in the transportation space. Earlier in college I was with utilities during deregulation. And we realized the pain point in mobility, and energy was in disadvantaged communities and income disparity.

And so we initially got into the business with AC Propulsion. That's when you hear that origin story of the demo projects, with the

ports. And what we did with cities and San Gabriel Valley, we donated an EV and EV charging, and this was right after the recession. And what we come to find out, we can add savings, but the hardware was very expensive, and the chargers didn't do much. So that's why we decided to make a smaller, faster, more affordable charging station for the future, so we can have more mass adoption, adding more bells and whistles.

COMMISSIONER MONAHAN: With the free charging, how, how do you financially make that model work? Do you get support from utilities or from any state agencies?

MR. FRANCIS: Well, fortunately, the State has done a great job with the rebate programs. So, as a manufacturer, when we're doing projects in some communities, we have those rebates that allow us to recoup our investment, right. And then you have your low-carbon fuel credits program. You also have certain IOU's have the load shaving demand response program that allow you to earn. And because our hardware can throttle power, we can participate there as well.

And then on certain private property,

universities, you had to digital ads. So when you add all those three components, we can still earn while allowing people to charge for free.

COMMISSIONER MONAHAN: Wow. And if your model -- like what's your vision for the future? Are you -- is it, is the plan to stay really focused in the L.A., Southern California region, or do you have bigger plans for expansion?

MR. FRANCIS: Much bigger plans, of course, is all of us do. California's the, you know, tech capital. So we are lucky enough, we're also Cleantech San Diego Incubator Company. They provided a lot of value and help getting some of our grants. That's a great program also the CEC supports. And then I'm going through that track, we are connected through Elemental Excelerator. That's a program that's helped us scale past six months.

Fortunately, EV charging is connected to utility grade infrastructure, which is essential. And we've had our best quarter ever during the last three months, and we're going to be installing over 100 charging stations in Hawaii next year. And we have some opportunities in Indianapolis, D.C. So we're excited about what's

to come.

COMMISSIONER MONAHAN: That's great to hear. With your model are you able to apply for any of the funds that we have through CAL EVI, the California Electric Vehicle Infrastructure Project?

MR. FRANCIS: Yeah. So their rebate program -- as a young business, as an OEM, because we do own design, we've had to go through certain certification processes. We're on the verge of completing our Energy Star, so that we are a qualified CALeVIP Rebate Program. We're excited about that. That's coming very soon.

But we're also at a ETL/UL Certified. So we are an approved So Cal Edison vendor, which has helped us get some projects like you saw the Fairplex Fairgrounds, and we're under that Charge Ready Program in Edison territory. It's helping us scale.

There's also in LADWP, they offer those rebates as well. So we qualify, and it's helping us right now in some of those communities get work done.

COMMISSIONER MONAHAN: And how much do you do heavy duty -- medium to heavy duty

electrification as a part of your business model?

MR. FRANCIS: Well, so medium and heavy duty we know will be critical. But one thing we're excited about there, in the event training program, our partnering electrician did a virtual field trip for the students. He did a site where he installed Level 2 Plus charging at bus yard, school bus yard in Downtown L.A.

And what was encouraging was they didn't use DC Fast charging for that project. Infrastructure costs a ton when you have to upgrade to that level of power. So they used Level 2 Plus, 80 amps, 19 kW.

So in 2021 our new Level 2 Plus model, we showed that small picture, will still be small, but it will be 80 amps, Level 2 Plus, so that those who are still manufacturing vehicles with the J1772 can still use our charger, and certain medium-duty sites don't have to upgrade power to the DCFC.

You're muted, Commissioner.

COMMISSIONER MONAHAN: My dog was barking in the background. So a common problem in COVID times.

Well, Paul, I just wanted to thank you

and really appreciate your presentation, really appreciate the inspiration. And, you know, I do think there's a lot of lessons from you're, the work that you've done to make sure that your attentive issues, that especially folks in the disadvantaged communities or low-income folks might face, and to me that's a critical aspect of transportation electrification, one we're trying to figure out how to do better on.

So, thanks for the, thanks for the presentation. Thanks for the inspirational speech. You're actually a, you're a really good speaker. So, better than we'd thought you'd be. You're excellent.

MR. FRANCIS: Thank you for the kinds words.

COMMISSIONER MONAHAN: So, thank you.

MR. FRANCIS: Thank you. Appreciate the opportunity, Commissioner, and thank you to everyone.

COMMISSIONER MONAHAN: Excellent. Alright, have a good rest of your day.

MR. FRANCIS: You, too.

COMMISSIONER MONAHAN: Heather, I'm going to turn it over to you to introduce the next

speakers.

MS. RAITT: Sure. So, yeah. Thank you, Paul.

So next speaker is Noel Crisostomo. And he is an Air Pollution Specialist in the Fields and Transportation Division at the Energy Commission.

And so Noel, he works tirelessly on charging infrastructure policy analysis and grid-integration technologies.

Go ahead. Noel.

MR. CRISOSTOMO: Thanks, Heather.

To get -- go to the next slide.

I work on a AB 2127 for the Fields and Transportation Division. And this first presentation will be the first of 11 presentations from Energy Commission staff, agency and research collaborators during the rest of our two-day workshop.

My presentation covers primarily findings for charging equipment hardware and software needed to meet the widespread adoption goals for 5,000,000 EV's by 2030.

AB 2127 was signed in 2018, but built upon a decades' worth of EV directives, including

Senate Bill 626 from 2009, SB 250 in 2013, that aimed to make charging widespread in EV used in California. However, no state as an island.

As the DOE we established a vision for global interoperability, where any EV can plug into any charger anywhere, anytime, and they're able to function without any special efforts from the user.

But California, however, has not achieved that goal yet. Interoperable hardware and software has wide-reaching implications of the charging networks necessary to meet EV targets. So I'll describe three examples related to connectors, smart charging and equipment management, in the context of the 2018 ZEV Action Plan has directed.

So the Energy Commission's developed innovative charging infrastructure deployment strategies, and 2030 infrastructure needs projections that spurred greater private investments through construction of infrastructure.

Next slide.

AB 2127 tasks the Energy Commission to consider all necessary charging infrastructure,

including but not limited to the existing and future chargers, the supporting hardware and software, make ready electrical equipment, and other programs to accelerate the adoption for all EV categories.

This afternoon my colleague Micah and I will cover these three cross-cutting infrastructure elements at the bottom of this slide, while tomorrow, my colleague, Matt, and our research teams will discuss future charging means.

Given the breath of the vehicle types that are undergoing electrification, as shown on the next slide, the legislature declared that EV's charging infrastructure with the ability to measure energy and remote way to communicate, could assist with managing the grid and integrating renewables.

First consumers could maximize their economic and carbon savings by using these smart charging technologies shown in the middle. So this is actually one of the more recent directives. Senate Bill 66 in 2009 established the Energy Commission to consult with a CPUC to ensure that EV technologies are harmonized across

utility service areas, shown on the left. And in January 2017, shown on the right, the Department of Energy identified that standardized, open charging systems that ensure easy access by all in a competitive and highly innovative market for critical for mass -- are critical for mass-market success.

On the next slide, these goals for convenience, controllable and competitive charging can be summarized by the vision for global interoperability that the Department of Energy and the European Commission's ED Smart Grid Interoperability Center described, where interoperability will provide standardized devices that are capable of functioning as intended with each other, without any special effort from the user.

They state that harmonized standards and regulations will create, one, interoperable cars, charging and communication networks, and, two, predictable investment requirements that are necessary to achieve scale.

On the next slide I'll depict how this is easier said than done, but the Energy Commission, along with its partners at the CPUC Division of

Measurement Standards in CARB, have already made some piece-wise progress on standards and regulations.

Overall, this slide depicts charging equipment hardware and software solutions. In line with the National Institute of Standards and Technologies, new Smart Grid interfaces category assessment, which states that, "a modernized grid would likely have to accommodate new types of communications interfaces, including new interfaces for new entities, interfaces between substrates -- subsystems, and interfaces for legacy systems."

Indeed, to realize this dismissed, high distributed energy resource architecture, open standards-based communication networks are necessary.

First, to enable, in orange and blue, the utility or an aggregator to remotely meter and manage grid impacts. Second, to enable, in green, a network to manage equipment, and in yellow, for networks to manage transactions amongst each other. And critically in red, a common and unique two-way communication between the supply equipment and the car, so that EV

charging is convenient across the state and across all use cases, whether it's smart charging, vehicle-to-grid or even wireless charging.

Shown on the next slide, these standardized interfaces face hurdles and require cooperation among competitors. Today drivers space of widespread sub-optimal charging experience in which they're faced with a dizzying set of options to initiate charging, ranging from presenting a key chain RFID or fobs, keeping a folder full of network apps, or can dial a phone number, or handle a credit card, if as Paul mentioned, if they are banked.

While credit -- while driver behaviors might change as new payments interfaces roaming requirements phase in, reliance on proprietary systems for replicating the gas station experience, could ultimately flow to be adoption.

Replicable simplicity is key. Where regardless of the many places you might charge, the ability to just plug in and be on your way cannot be beat. Indeed, the Tesla charging experience is simple, but is not being replicated by other OEM's. On the other hand, the commonly

J1772 connectors could be designed with a much simpler interface, but it is difficult to coordinate the implementations of multiple OEM and charging manufacturers.

Overcoming this conundrum requires instead of -- overcoming this conundrum requires instead for competing networks to cooperate upon implementing common systems to arrive at a win-win situation.

Coopetition is where the network's agree upon vehicle charger standards, vehicle and charger standards which would provide greater certainty for suppliers with enabling hardware, automakers and their drivers, so that everyone can plan for larger volumes that drive down costs.

Shown on this graph, note that the cost merely -- note that the cost graph merely offers an example of the suppliers of the Marshall transceiver, that can enable, quote, "high level communication for a trade of smart charging parameters, and is not a suggestion for specific implementation by manufacturers." But this shows how -- shows a real-life example of how scale could drive down costs.

Some parties assert that cooperation upon standards is anti-competitive or antithetical to innovation. But, on the contrary, as illustrated at the bottom, there are four different -- at least four to the form factors shown here with innovation surrounding the smart charge interface. These are all happening today, and will continue as the majority of automakers that are adopting vehicles with so called, "title mutation standard," start to roll out their infrastructure.

In the next slides, I will highlight the benefits from three interoperability efforts, and describe their knock-on effects for other infrastructure deployment strategies.

Standardized connectors are a critical factor in creating a convenient charging solution for customers. At the highest level, harmonizing the physical connection, for example, with the combined charging system noted here, reduces the size of needed network by maximizing the number of vehicles a connector can serve power to.

A 2019 research report from Massachusetts Institute of Technology has quantified that this improves consumer benefits, producers -- reduces

network build costs, and enables more EV sales.

In the IEPR Workshop in -- on charging in June, EVgo and Electrify America suggested that funding programs consider connector interoperability at the station level, rather than the individual charger level, to reduce equipment costs.

CEC's analysis with Pen Real (phonetic) on EBI para-road trip, which will be discussed Thursday, illustrates the importance of connector-level interoperability in managing the stations' loads.

Not only form, but also functional communication is key. A heavy-duty truck stakeholder's frustrations tells it all. So, interoperability is confusing. Those that have already bought some EV's and chargers buy more, and they just expect that it will all work, but they don't, because standards continuous evolve, as well as the companies that are implementing them.

It is critical that the State prepare and signal its support for interoperability efforts, given long lead times. Towards this effort, the Energy Commission is supporting NREL testing of a

high power charger for commercial vehicles, depicted on the right.

Next slide.

Standard space for smart charging is becoming more common in charging infrastructure efforts.

Next slide.

Utility programs today implement the Aggregator pathway, just like here, but have not linked the last leg of charging communication as shown in the prior slide. To correct this and -- prior slide.

To correct this, and in alignment with the Energy Commission's proposed specifications for CALeVIP -- prior slide -- the CPUC's key framework proposes to implement the ISO 15118 standard for high-level communication.

I appreciate work close -- working closely working with my colleagues in the Energy Division, led by Carey Cisco (phonetic), to unify and leverage our initiatives in smart charging.

The benefits of implementing smart charging with a common, unique and bi-directional communication between the networks, between the networks charger are clear.

Next slide.

First, automation makes participating simple for the driver, because drivers do not want to be bothered. Second, studies from Berkeley Lab, NREL, UC Berkeley, Caltech and Power Flex commonly show that drivers ask for more energy than they need sooner than their actual departure, limiting demand management potential.

To bring forth innovative financing models to front the value of grid services or avoid upgrades for the potential is fund chargers with these, those funds of money, is critical. It is critical to maximize flexibility with high-level communications.

And lastly, research shows that customers are willing to pay for the incremental equipment costs to enable smart charging. And this is shown by charging equipment, at least on the component size -- on the component side, of being first cost profitable for manufacturers that produce at volume.

Not only is this network's equipment useful for smart charging, but on the next slide I highlight the benefit of managing the equipment

itself and payments across different networks. Managing equipment and connecting networks co-requires the coopetition that I described earlier.

Starting at the bottom of the picture, charger-to-network communications enable real-time monitoring and the infrastructure to provide users the confidence that charging is reliable and available to them.

For example, the open charge point protocol can provide optionality for customers who might need to switch from providers that has gone out of business. This technology could allow for the equipment to be repaired by technicians, and then onboarded into a new network, to connect their respective clouds above -- in the middle of the page, networks are connecting bilaterally to settle driver payments. And with networks, as smart chargers more -- grow more organically, the market could find it more economically efficient to consolidate transaction handling with a hub-and-spoke model.

But these, too, are also challenging in practice. One manufacturer has stated, one language is needed for chargers to work with

different networks. And a second emphasized that these critical should be, quote, "turned into real standards and not left too open to interpretation," such that these cases are, quote, "defined exactly to which options are implemented." And the third stated bluntly, we struggle and interoperability tests.

Sentiments like these substantiate the needs to collaboratively debug these issues, so manufacturers can commercialize these advanced solutions to begin -- commercialize these advanced solutions.

To begin wrapping up on the next slide, adjoining each of these hardware and software elements is critical for the State to realize long-standing legislative directors to make charging convenient, controllable and competitive for California.

As we plan for more EV's, harmonizing standards to create economical solutions that fit into the diversity of California towns and cities is critical. It's also important to protect public investment and lay the groundwork for innovative financing, for example, by providing grid-integration services, that I'll describe

after Micah's presentation, on grid and touch planet.

Cooperation among competitors will be needed to create a more robust supply chain and expand a reliable self-sustaining infrastructure powered for all. So while interoperability is key to our success, on the next slide, unfortunately, the market remains fragmented. The IEPR, which has -- had focus -- the IEPR which had a focus on flexibility years ago, recommended that the Energy Commission work with the CPUC, other agencies, charging and car manufacturers to, quote, "help standardize charging equipment to better integrate electric vehicles with a grid." This was in 2017.

In the past three years our already ambitious clean energy and transportation targets have accelerated in scope -- accelerated and broadened in scope. However, unfortunately, despite our research on grid benefits, from Epic and EVI-Pro, consumer focus groups and equipment analysis were seemingly stuck in turtle mode on an issue that requires acceleration. The State should work toward the vision for global interoperability where charges can converse with

EV's that will roll off the production lines of the vast majority of automakers, so that the vehicles and the chargers working together, and not in contention, are ready to absorb the hundreds of gigawatt hours and solar and wind curtailed each month.

Fortunately, the Energy Commission and its partners can get back on track. First, automakers should continue the development of smart charging standards so that they can compete on an elevated, level playing field, one that simplifies charging for the mass market EB driver.

Second, to accept these resources in the field, we have to simplify laboratory testing without compromising safety. As I described, manufacturers dread is slow, uncollaborative and costly process to get their equipment and vehicles validated, to just charge and discharge as a smart system.

Third, to reciprocate these substantial efforts, California should invest in those proven chargers that are compatible with automaker technology plans to drive down costs for everyone.

And finally, to realize the savings, utilities should support customers where infrastructure upgrades are unavoidable, despite these integration efforts. And connecting with aggregators to lever behind the meter and ancillary services.

With that, I'll remaining on the slide. So thank you for your attention, and I'm happy to take questions.

(Pause.)

MS. RAITT: Commissioner Monahan, are you available? You might be muted.

COMMISSIONER MONAHAN: Sorry about that. I don't have any questions, but thank you, Noel.

MR. CRISOSTOMO: Thank you.

MS. RAITT: Thank you, Noel.

So this is Heather, I will go ahead and we'll introduce the next speaker, is Micah Wofford from the Energy Commission. And he's an Associate Energy Specialist, and is going to speak to us about EVSC development and grid -- and the Grid Evaluation Tool, or EDGE Tool.

Go ahead. Micah. Thanks.

MR. WOFFORD: Thank you, Heather. Good afternoon everybody, and thank you for

participating in today's IEPR Workshop session. My name is Micah Wofford, and I'm an Associate Energy Specialist, as Heather said, in the Transportation, Planning and Analysis units within the Field and Transportation Division.

Today I'll be presenting on the EVSC Deployment and Grid Evaluation Tool, otherwise known as EDGE, and how it is connected to the overall family of analyses taking place in the CEC and through our partners.

Next slide please.

So here's an outline of the presentation. I'll start broad with some policy background and objectives to provide context. Then we will move on to talk about some of EDGE's design choices and implications.

Finally, we will end by highlighting a conceptual metric called the, "Equitable Smart Charging Factor," which is a specific use case that comes out of the tool. And then finally, as well, some analytical limitations.

Next slide., please.

So through Assembly Bill 2127 the CEC is tasked with assessing the charging infrastructure needed to support the target set forth by

Executive Order B4818, which calls for 5,000,000 ZEV's on California road by 2030. Additionally, as we heard earlier today from Tiffany, SB 1000 tasks the CEC with evaluating light-duty charging infrastructure to identify whether deployments, including distribution and access, is disproportionate by geography, population density and income level.

And finally, with ongoing AB 2127 infrastructure analyses, they endeavor to quantify the number of chargers needed by type and location to reach California ZEV deployment goals.

Next slide, please.

To carry out the tasks necessary to properly plan for EV charging infrastructure, we need to -- we need an analytical process flow that generates insights and direction for the market, so we can ultimately deploy sufficient infrastructure for all.

As an early warning system, EDGE will help users focus deployment strategies and plan infrastructure investments to address four distinct goals, minimize and mitigate the impact of charging to the electric grid, achieve air

quality improvement targets, meet EV travel demands in California, especially as EV adoption rates continue to climb, and ensure the equitable deployment of EV infrastructure throughout the State.

These goals correspond to four unique conceptual domains of study with EDGE, grid impact, air quality, travel demand and equity considerations. The graphic on the left shows a high level cyclic process for achieving infrastructure deployment goals, and to an extent, EDGE will assist during each of these four steps.

Next slide, please.

The charger quantification results that are output from both the EVI-Pro and HEVI-Pro models will be used as the primary basis upon which data from other analytical domains will be layered. This will provide a foundation for users to view progress to infrastructure-related policy goals, strategically target deployments solutions, and focus investments.

Domains that I previously mentioned are separated here on this slide, as well as some of the data sources within each. EDGE uses data

from the investor-owned utilities integration capacity analysis maps to analyze the EV charging capacity of the regional distribution grid.

We are also working closely with the Energy Assessments Division staff to incorporate their GHG emission factor work into the model to assess air quality improvement strategies.

In terms of travel demand, EDGE utilizes AFDC charging -- or AFDC data regarding the environment of existing chargers to compare with projected needs in order to assess the statewide infrastructure gap.

And, finally, the Tool will also include results from ongoing SB 1000 analysis that CEC are conducting, to ensure chargers are distributed in an equitable manner.

I'd also like to mention that EDGE uses data from the Location Affordability Index to assess the value of smart charging solutions based on factors such as auto ownership burden and grid capacity deficit. I'll expand on this a bit more towards the end of the presentation.

Next slide, please.

This is a visualization of EDGE's overall framework. The data from the last slide, as well

as other sources, are input into EDGE for processing and combination. As model outputs -- model outputs are then viewable using EDGE's geospatial domains as filters or lenses.

The table on the right lists the relationships between the domains in terms of the units of spatial resolution. The EDGE Tool notably targets the Traffic Analysis Zone, or TAZ, as the smallest unit of resolution for most domains. Units in the same color here tend to fit nicely into each other. This table provides a glimpse at an important barrier that exists within the data.

Although some domains have the capability of sharing spatial units, the data are generally not commutable across domains, which means it's not easy to convert between sets to view meaningful correlations. And as a result, statistical analysis of the physical characteristics of each domain is required before invoking EDGE's inherent algorithm. However, before getting into EDGE's geospatial analysis, I'd like to briefly talk about the traits which define the TAZ.

Next slide, please.

When determining the shape and size of the TAZ, one must consider some constraints. Origin and destination trip totals must be controlled. The total number of interzonal trips must be minimized, and statistical position must be relatively high.

Ensuring that these constraints are addressed yields similar quantities of trips simulated across TAZ regions, while also indirectly controlling a relatively -- relative statistical error. Additionally, the density of resulting TAZ regions is proportional to the number of trips generated in that area.

The figure on the right shows the distribution of TAZ regions in redline, within L.A. County in blue line. EDGE is currently utilizing TAZ data from the Caltrans California statewide travel demand model.

Next slide, please.

These two plots show how our targeted unit, the TAZ, relate to different levels of resolution within the same domain, as well as across domains. Regarding the travel demand domain, on the left is a histogram showing the distribution of TAZ's within counties. As stated

in the previous slide, TAZ's are generally sized based on the density of trips generated in their respective area. This means that counties with more TAZ's in them we'll have a higher volume of traffic and, therefore, may require a larger amounts -- larger amount of chargers to support their needs. however, this is a view into just one domain.

When crossing the grid in travel domains, we must allocate available capacity to the TAZ level. On the right is a preliminary plot that shows the distribution of available load in TAZ's by county within Edison's territory. It clearly shows that the majority of TAZ's here, about 48-percent or so, have zero megawatts or less available capacity to accept new load from EV charging infrastructure.

This highlights the need to work closely with the utilities in order to obtain a better understanding of grid operations and ways to mitigate EV charging impact.

Next slide, please.

To walk through EDGE's capacity allocation methodology, I'll show an example here where we consider three adjacent TAZ's, A, B and

C. As I stated earlier, EDGE is currently using distribution-grid data from the IOU's ICA maps, which assign information to specific distribution feeder circuits at the street or parcel level.

The black line here is a simple theoretical version of an ICA feeder circuit. As you can see, the physical design of these circuits can be complex, and so these data are not evenly distributed within TAZ boundaries, and they can sometimes span several unique zones. Therefore, in order to properly assess the available capacity within each TAZ, EDGE utilizes the TAZ boundaries as sort of a cookie cutter to slice up the ICA data.

Since each ICA circuit line has a unique system name associated to it, we can then assess the physical presence of each line within a TAZ boundary and assign a ratio to each new piece. The algorithm then looks at each TAZ and iterates through the cut-up line pieces inside. Then multiplies the ratio we found earlier by the load capacity of the overall line.

And finally, EDGE sums up the capacity on each of those pieces to produce an aggregate result assigned to each encompassing TAZ. This

process is captured by the formula in the top-left portion of the slide.

So in this example, if this black line was the only circuit that serves each of these TAZ's, then each of these TAZ's would have the megawatt capacity values assigned to them as shown on the slide, .5 megawatts, .3 and .2.

Next slide, please.

This is a view of the EDGE map currently showing ICA data allocated to the TAZ level in an area near San Bernardino. Near the top of the map is a box that shows this -- that this particular tasks has 51 megawatts of available capacity. In this example, several distribution and fulfillment centers lie within this TAZ, as shown within the superimposed satellite map screenshot in the center.

In -- let's see. It should be noted that EDGE is not intended to be a micro-siting tool, but instead, this situation is a good example of what EDGE can do in terms of finding locations that are suitable for planned additional loads and allowing users to focus their deployment strategies.

During this session's next presentation,

Noel Crisostomo will discuss how new policies can assist in reducing grid capacity impact from rapid electrification efforts, such as how Amazon is electrifying its distribution center fleets and using Rivian trucks.

In this example, 51 megawatts of the available capacity to absorb new charging loads, so anything planned beyond that would require some sort of mitigation solution or distribution-grid upgrade.

Using the theoretical approach from the last example, we can apply -- I'm sorry. Next slide, please. Thank you.

Using the theoretical approach from the last example, we can apply a similar methodology to address the barriers present within both the equity and grid domains. In this use case, we are particularly interested in understanding the value of smart charging and VGI in communities that are most economically vulnerable.

The equitable smart charging factor, as I'm calling it, utilizes data from both of the IOU's ICA maps and the Location Affordability Index to create a juxtaposition of grid negativity and auto ownership burden values

respectively. It uses several factors from both data sets to quantify or score the value of charging -- smart charging solutions within communities with high economic burden. This concept, though, is still in development, but it can be used to reduce auto ownership burden in the context of grid-constrained areas, ultimately assisting and targeting equitable VGI projects as a direct compliment to TERPA.

Next slide, please.

To highlight some of the limitations of EDGE, these limitations primarily lie in the integrity of the ingested data. The ICA data has been an issue in terms of spatial discontinuities and validation frameworks.

The image on the right is a good example of the discontinuity problem. This is a screen capture of the SCE ICA map, showing lots of interesting gaps between lines that should otherwise be connected. This makes the unique circuit identification and allocation a bit more complex.

Another limitation is that the Location Affordability Index has good information from various sources, but most of them are a bit

dated, such as the longitudinal employer household dynamic data from 2014, vehicle-mile-traveled data from the 2013 to 2015 range, and also the American Community Survey stats from a five-year period ending in 2016. So obtaining more relevant data is also one of the main inhibitors.

EDGE is only as good as the data going into it. So finding and implementing richer and more robust data sets is critical to providing more accurate and informative results.

And finally, EDGE's algorithm itself is still in development and requires more streamlining as more data is integrated within it. The Tool will continue to evolve as more relationships and connections are established in the data sets across each of the analytical domains.

Next slide, please.

And so to continue the development process of EDGE and recurrently improve upon its design, we welcome stakeholder input on a number of items. What additional data sources exist that could inform travel volumes between origins and destinations or provide grid-capacity

estimation and validation? How can we improve the allocation algorithm within EDGE? We welcome feedback also on the types of use cases that we are planning to incorporate. These include smart charging, air quality attainment, carbon emission intensity and equitable infrastructure deployments. As this Tool will eventually be made publicly available, how can the user interface be designed in such a way that would be most user friendly?

Also, the utility data going into EDGE is critical om allowing accurate analysis of regional grid conditions, and the ability to host expected new EV charging load. Therefore, how can the CEC work with the utilities to ensure that their data are easily accessible and accurate? How can we secure that grid data going into the Tool?

Next slide, please.

So this concludes my presentation. Thank you very much for listening. Please feel free to reach out to me for further discussion using my contact information displayed on the screen. And I'm also happy to take questions now.

Thank you very much.

COMMISSIONER MONAHAN: Thanks, Micah. I've just been in contact with Heather about whether we can get Q&A from the audience, and sadly we can't.

I'm curious, you know, for the folks listening in, what -- you list some questions and, you know, your contact information, but we have a pretty quick turnaround schedule for AB 2127. And I'm curious, just so that folks listening in can provide the most helpful feedback for that process, what would you encourage in terms of timing and substance for comments?

MR. WOFFORD: So, in terms of timing, EDGE is pretty contingent on the preliminary results coming out of EVI-Pro analysis. So once those sort of get finalized and shared, then we can incorporate those into the EDGE Tool. That way we can have some of those results feed into the AB 2127 reports.

So, I mean comments coming in as soon as possible on the EDGE Tool and its data would be very helpful.

COMMISSIONER MONAHAN: And have you already gotten feedback from stakeholders in this

process? And I'm thinking especially the utilities were providing some of the critical data.

MR. WOFFORD: Right, yeah. So this is really the first time that EDGE is going public. I've been working with the utilities in terms of trying to get access to their data, and, you know, find ways in order to accurately incorporate that into the model, but, yeah, like I said, this was the first time EDGE is going public. And, yeah, I welcome help from any stakeholders.

COMMISSIONER MONAHAN: And then I'm curious that, you know, there's sensitive business information and there's a public component. How are you juggling those two in terms of, you know, wanting to show to the public the most we can from this Tool, but also having some sensitive data that we have to be careful about?

MR. WOFFORD: Right. Yeah. So the ICA data themselves are, actually they have a lot of redacted information there inherently. And so that's sort of propagating through into the EDGE Tool. But EDGE also aggregates up further

levels, and so that information is protected via aggregation. And then the rest of the data going in at this point so far are all pretty much publicly accessible, so there's really minimal privacy concern.

COMMISSIONER MONAHAN: And how much of the Tool will actually be -- can you envision would be made available to the public?

MR. WOFFORD: I'm hoping that EDGE can sort of live as like in a terminus points in all of the expanded EVI-Pro and HEVI-Pro analysis. So that will -- I'm hoping it'll sort of live as a data hub, to where all of the models, data that comes out of them can, sort of be integrated together and viewable, and, you know, you can crosscut through the different domains that I was explaining before. So I'm hoping all of it can be viewable through EDGE at some point.

COMMISSIONER MONAHAN: Any idea about what that timeline would look like?

MR. WOFFORD: At this point, I don't really have an answer to that. But preliminary results from EDGE are, like I said, are contingent from EVI-Pro's sort of first, first pass. So as soon as those become available, I'm

hoping the test some public facing prototype.

COMMISSIONER MONAHAN: Great. Excellent.

MR. WOFFORD: Yeah.

COMMISSIONER MONAHAN: All right. Well, thank you.

MR. WOFFORD: All right. Thank you so much for the opportunity.

COMMISSIONER MONAHAN: All right.

And, Heather, we'll turn it back over to you for -- to introduce Noel again. All right.

MS. RAITT: Okay. Well, I think you basically just did it for me. So, yeah, so we get to hear from Noel again.

So go ahead, Noel.

MS. RAITT: You're muted, Noel.

MR. CRISOSTOMO: Sorry. Double meeting.

The next slide.

To outline my talk, which Micah set up very nicely, and if there's interest later -- there was a question that was, was chatted to me in the, in the chat. But to get to that later on after my talk.

First I'll describe during this presentation where AB 2127's directive to look at other necessary charging infrastructure programs

juxtaposes with the broad swath of work in that directive.

Next I'll explain the aim and process of one conceptual other program, the Transportation Electrification Regulatory Policies Act, inspired by the similarly named 1978 policy at the national level, requiring utilities to purchase power in qualifying facilities.

This idea represents the collaboration with my colleague at CPUC, from the measurements of transportation education programs, and build upon prior presentations shown here.

Today I'll delve into a hypetha (phonetic) and a hypetha act, a hypothetical process to -- I interpret in two parts, assessment and delivery of one charging use case in the context of our innovative infrastructure deployment strategies described earlier.

To emphasize this is a hypothetical proposal that attempts to answer initial comments that we received, and we continue to seek improvements to understand how it might be implemented.

First shown on the next slide, AB 2127 tasks the Energy Commission to -- that’s charging

infrastructure needs across various program elements in transportation segments, including, quote, "other programs to accelerate the adoption of EV's."

Considering this directive in our March 2019 IEPR Staff Workshop, I emphasized that, quote, "accounting for interaction between infrastructure factors is important." For example, infrastructure must fit into the broader system of vehicles used and travel demanded. For example, the makeup of the network serving automated, shared and ride hailing EV's would be very different compared to personally-driven ones.

Second, charging assets can be deployed at different speeds, since transportational electrification includes, quote, "charging electricity from external sources of electric power, including from distributed energy resources aside from the grid or as an enhancement to it," as highlighted during our EV Resilience Workshop two weeks ago.

And third, these infrastructure factors should also account for the design of incentives that are supporting the market, but could benefit

installations, but also have unintended consequences.

On the next slide, TERPA addresses and harnesses these factors to form a structure with the intent to electrify transportation at the speed, scope and scale necessary to achieve air quality targets and decarbonization. In short, the purpose of TERPA is to accelerate widespread transportation electrification, while leveraging limited public forums with private capital.

It's clear that our multi-prong infrastructure efforts thus far needs to accelerate. First to accelerate products and solutions, but not as a singular focus of connector counts. As NREL is show during our presentation Thursday, supplying sufficient energy to be utilized among geographically distributed infrastructure is the core challenge of charging.

Technology capability and business model design can change what the -- of which the network look like. To this point, the network should seek to maximize the electric miles enabled by each project under a broad scope that covers the various transportation models.

And lastly, given the economic downturn, we have to be strategic in our funding so that we are laying the groundwork for sustained scale. This includes improving upon older programs and writing poor market signals that might pause investments, where, for example, site hosts wait until more lucrative signals -- where more lucrative incentives are available or value stacking, which might find intentionally over incentivize the project at the expense of reaching more sites.

Shown on the next slide, overall, TERPA intends to assemble the diverse, but often disconnected infrastructure efforts, at the state and local level with industry players, EVSP's and utilities.

Stakeholders have raised the need to improve inter-agency coordination on infrastructure programs, what was best for our last unified policy and economic model to maximize their ability to truly complement each other.

TERPA, as depicted here in two phases. First, multi-scale markets testaments to inform reverse auctions backed by a pool of public

funds, seeking the most effective portfolio of projects at the level needed to meet California's transportation electrification law. Using the avoided cost of charging as a unified measure called, "investments efficiency," to enable electric travel that's reverse auction, induces the market competition to identify a supply of grid-integrated projects.

This transitions to the second phase in which the avoided costs derives the budget that can be tailored to overcome the unique challenges faced by each respective service provider, as well as to result constraints on broader market growth.

And finally, these result in installations that are backed by longer term certainty to enable financing for projects to which utilities provide load service and electric rates. Understandably, this is a lot, so on the next slide will piece apart a realistic but fictional example.

So as many of you know, the Commission has invested in regional planning, and more recently, community blueprints to improve readiness.

For example, last year's Port of Long Beach blueprint identified the need for a variety of conventional stationary, mobile and even micro-grid based charging that could be needed to serve its effort to transition to a fully emission -- fully zero-emission Drayage Truck fleet in 15 years.

Beyond the report, they highlighted that regional infrastructure plans would be needed to recharge these trucks when they move goods to the Inland Empire's distribution centers.

Next slide.

The blueprint cautioned about the need to prepare for electrical upgrades necessary to move towards the zero-emission operations and its implications for broader grid planning as a core node affecting many other utilities in Southern California.

Thankfully, as Micah showed, Edison's integration capacity analysis maps can be used to plan this regional Drayage infrastructure. Building off of this example describes in EDGE, if three goods move in customers shown here, require electrification of around 61 megawatts for 10 megawatts of load in excess of what is

available in that distribution zone, Edison might need to upgrade a trip -- a primary transformer at a cost of $400,000.

Next slide.

And to meet this need, incentive programs could establish an opportunity for EV service providers. To cure, the Energy Commission could establish minimum provider and technical requirements, that we understand some EVSP's bulkanized across program administrators, which limit economies of scale, planning and interoperability.

In TERPA we propose that given the independent, statewide and long-term perspective that the Energy Commission has built to encourage a successful private and public charging infrastructure market, that's the Commission qualify suppliers, so that they can participate in a reverse auction backed by public funding

To maximize leverage, this could pool clean transportation program funding, local funding from cities or air districts, and even utility rate air investments, to maximize the efficient access to market opportunities for the many EVSP's operating in California.

This qualification process would be compared -- would be comprised of impartial due diligence of the company, and to ensure that EVSP's leveraging technology with our state, grid, grid connected and interoperable, we could include the specifications as described in my prior presentation.

Next slide, please.

In preparation for the reverse auction, qualified EVSP's would conduct outreach to customers to activate projects with private financial backing across the geographic scope of the investments.

In this example, given information about the distribution center fleets, they would develop bids calculated as the public investment needed, to offer the energy capabilities that the customers demand. The avoided cost of charging the bids would represent the viability of the EVSP.

Essentially, by having to minimize the cost, service as a prospectus for the EVSP's ability to attract private investment from private finances, representing the minimum amounts of public funding needed to sustain their

operation for the auction's delivery period. Importantly, this request for funds is normalized for the electric miles that they could prove with existing technologies or future innovation. And it is also normalized by their ability to quickly deploy charging infrastructure with installations.

In short, this metric incentivizes a fair competition between EVSP's to offer the most effective public investments to enable electric miles.

On the next slide, I'll show example bids into the reverse auction, to serve the distribution center's fleet of Drayage trucks. So let's say that the Port of Long Beach teams up with Southern California Association of Government, backed by funding from SCAG, they pair investments to solicit Drayage truck charging infrastructure.

In response to this possible RFP, three service providers offer bids with combinations of three charging solutions shown above. With -- as identified in the blueprint, that are best fit for the warehouses given the real estate requirements.

In this illustrative example, a bid from the first service provider to be stationary chargers serving 10,000 kilowatt hours a year at a cost $5 dollars per kilowatt hour.

The second's mobile charters offering 5,000 kilowatt hours at 10. A third, implementing a combination of the two, with a distributed generation microgrid for deciliter purposes, could offer 15,000 kilowatt hours at $12.

Rank ordering these solutions determine the cost of supplying sufficient energy for the Drayage trucks. And so the next logical question that I've received, shown on the next slide, is how would we determine that demand?

In complements the bottom-up analysis from the blueprints, the Energy Commission's Hevi-Pro Tool can find the regional energy demanded. Please join Thursday to learn more from our partners at Berkeley Lab.

And in this example Hevi-Pro could quantify the charging and demanded from the fleets, combined with local and state electrification regulations to be roughly 25,000 kilowatt hours per -- in 2020, just as an

example.

To account for the speed of delivering the energy to the trucks, while not illustrated here, the charging demands to be tranched according to power level. Calibrating these tranches will require close collaboration among state and local analysis to map technology options sub-segments served

On the next slide, comparing supplier's bids against the regulatory demand, we can discover how much the public sector would have to invest to the truck's charging. Shown in blue, the trucks would require investing -- an investment of all three EVSP's, but for all but the last 5,000 kilowatt hours, a micro-grid could supply. This procurement clears the market with a cost of the third supplier at $12 per kilowatt hour.

A frequent question that has challenged public stakeholders in our and other agencies' investments, is how the public's willingness to invest to change over time, accounting for the risks and benefits of new technology, and more expensive -- more expansive decarbonization policy.

On the next slide, these can be abstracted as sensitivities as the supply and demand curves. For example, a downside technology risk could be the third EVSP'S micro-grid controller experiencing a contingency with one of the vehicle-distributed energy resources. On the other hand, and upside risk could be the continued decline in the cost of storage.

As California continues to accelerate its timeline to meet air quality goals or add some new vehicle sectors into the scopes of regulation, the reverse auction for any given year could demand more energy shifting the blue area to the right.

On the next slide we transition to phase two to select the investment portfolio. Having quantified and mitigated supply and demand risks, the auction would find most efficient and the diversified portfolio charging suppliers. To emphasize, at this point, we've been able to find a sufficient set of infrastructure solutions that are least costly from a public investment standpoint, because the avoided cost of charging bids pose competitions that incentivize EVSPS's to backed by a private investors. In a sense,

TERPA converges independent suppliers mobilizing to meet an objective amount of charging needs with a unified pool of public investment that is defined -- designed to offer more patient capital to complement independent product financiers.

On the next slide, I show two options to the budget of the public investment. On the left I show a payout assuming to 220,000 to the three ESVP's based on their respective at-cost bids.

On the right I show a count of $300,000. So the three EVSP's, based on the marginal cost instrument, for the market-clearing price to serve full amount of energy required.

Economists would recognize that the difference between the two options is the producer surplus, which is the investment between how much a EVSP's would be willing to accept for supplying energy versus how much they could receive at bidding the market price.

But since the market price for sufficient infrastructure is largely unknown, most sufficient suppliers in an aggressive investments scenario, would benefit from their ability to beat their competitors on business model and price.

These same economists might remind us that producer surplus may represent an overpayment for the required charging of energy. But on the next slide I'll explain that there might be a useful purpose for these funds, if used carefully.

We know that the EVSP's are part of a broader ecosystem of manufacturers, city planners, workers, utilities and more. And these could be other x-factors that constrain the rate of installation.

For example, in the absence of AHJ permitting staff, or dearth of high voltage electricians to build and upgrade the grid region -- in the region, this could limit the rate of installations and jeopardize attainment.

While these market constraints are not caused by the EVSP, an aggressive investment stance could help alleviate the variety of the barriers early on in the transition.

Overall, the last step in the investment can circle back to check about how the proposal rewards compared to the utility's proposal to invest in conventional grid upgrades. Using this avoided cost model as a benchmark against

conventional system expansion, we can have the effect of monetizing the long-elusive value, efficiently integrated charging with the grid, but this requires solving the grid-data validation challenges Micah described.

On the next slide I'll highlight a key benefit of the TERPA avoided costs charging model, which comes from the fact that no EVSP's are exactly like, as Paul described.

So in this this vein, I can take comfort in the belief that there's no -- that, quote, "there is no business model in reselling power because, thankfully, pursuant to AB 631, reselling electricity is not the prime motivator for the EVSP's business model."

The market for charging is so diverse, because it crosses real estate, parking and site-specific customer services and amenities, with rapid changes in the form of how we use, store and even transact power.

Think of a nonlinear and potential peer-to-peer charging services from vehicle to grid, as described by Honda and Kia in July. TERPA harnesses that diversity with the one-cost framework and allows for EVSP's bids to be set at

their particular need for public funding, with awards tailored to flexibly address individual business model challenges.

For example, the first EVSP offering Depot chargers, and our $50,000 award funds temporary demand charge rate relief, as the fleet grows in size, especially the installation is occurring during an inopportune time during the rate design window.

Second, other EVSP's, $50,000 could support manufacturing line expansions. And the third EVSP's could connect to the grid and pay for control of equipment. Under TERPA the charging suppliers compete upon an equal playing field, with a potential expense of expanding the distribution of the -- the charging supplies would compete upon an equal playing field, with the potential of expending capital on an expanded distribution system.

And DB utility upgrades or at least cost solutions. Those would be pursued as complimentary solution after maximizing the benefit of grid-integrated charging and the deployment of other distributed resources in line with the distribution management goals of AB 327

from 2015.

On the next slide I'll highlight core roles of the utilities putting all this together. With a certainty that their barriers can be -- various entry can be surmounted with public investments, the EVSP's can finally begin the projects delivery.

In sequence, the utilities construct unavoidable grid upgrades, and quickly energize the stations as the stations are build. And serve their core responsibility to design rates that serve the distribution warehouse and the truck chargers together.

To emphasize, please recall Nuvve's comment during the June workshop, emphasizing the need to serve marshaling costs and rates for EV's. And the load at the building, so that vehicles are integrated with the grid, not just added to it.

A summary of the TERPA process is shown on the next slide, which I won't go through in favor of letting people read that on their own. But it serves as a blueprint for stakeholders to build upon with comment.

Clearly, TERPA requires a great cross-

sector coordination, but we know that this is necessary to rise to the challenge, codes as we electrify. We offer this proposal seeking your support, because as shown on the next slide, TERPA offers a unified model to deploy infrastructure to speed, scope and scale necessary to meet our goals.

And so in conclusion, with your help, TERPA could quickly allow for market injection of leverage funds to expand technology manufacturing and propose a mobilization to deploy charging with greater long-term certainty to investors.

Second, that can be flexible and broaden the scope of charging solutions and promote their competition based on minimizing social costs, to enabling an attainment level and decarbonization level of electrification and electric miles.

Finally, leveraging the avoided-cost model will send market signals and front the value of innovative grid-integrated alternatives that are less expensive than conventional solutions, allowing us to scale deployments while offering a path and access larger pools of capital than we are currently mobilizing.

I'll conclude here staying on this

slide, with advanced appreciation for your time and feedback, in helping continued development of this concept.

Commissioner Monahan, I'm happy to answer to answer questions or questions from the audience. Thanks.

COMMISSIONER MONAHAN: Thanks, Noel. Now I know, I'm supposed to be asking questions.

So, I am wondering -- I mean you presented this concept at the workshop that we had with Commissioner Rechtschaffen from the Public Utilities Commission. What kind of reaction have you gotten from different stakeholders to the to the TERPA concept?

MR. CRISOSTOMO: Sure. Several stakeholders have been pretty excited about the opportunity to front the value of grid integration. That's -- as we were talking with Gridworks recently during the last IEPR presentation, that could be really a compelling opportunity to combine charging infrastructure planning with our grid integration goals.

In addition, there's great interest in how this could offer a longer term planning opportunity for EVSP's as they develop projects.

It allows for, kind of confidence to our first come, first served rebate models. And there's requests to think about how these pieces fit together.

In addition, there's feedback from utilities who -- maybe I kind of named this poorly. I got a little bit concerned about the TERPA, the call back to TERPA, in which long-term contracts, 30-year contracts were established. But I've made -- I've tried to answer their questions about implementation, how the money flows, which is not just a utility question, but project developer question.

To show in this example -- I'm sorry for running over, but it was important to bring this, bring this to light and answer some questions.

How this actually could work in the context of all the other different things that we do at Energy Commission. That was one with common questions. Do we have the ability to analyze this? And I think if we put all the different parts together, That could be an opportunity, while also avoiding the risks of long-term contracting, but also offering a way to give investors some certainty.

So, in, in short, there is positive reaction, there's great interest. I actually heard from one stakeholders who said they brought this to their project finance folks, and they got pretty excited and want to bring this to Colorado. They want me to present to the Governor's Office in Colorado. I was like, well, let's develop this a little bit more before I'm on the hook for that.

So, I think overall it's been positive. And it's definitely not finished. So, even though I have provided the detailed example here, we'd like to receive more ideas.

COMMISSIONER MONAHAN: And which stakeholders are particularly interested in getting feedback from? Like who do you think needs to have eyes on this proposal to help shape it in the right way?

MR. CRISOSTOMO: So I've received feedback from the EVSP's, utilities, some environmental organizations who really want to move at the speed, scope and scale of decarbonization. And so, more feedback from ratepayer advocates, more feedback from automakers who want to understand the value of

vehicle-to-grid, which fits, as I alluded to in this concept, would be very valuable, as well as others that haven't heard from.

Financiers, along the lines of Tim's private capital initiative, would be very welcome, to see if this provides the long-term market signals that we're hoping to enable a transition to private efforts and the public compliments to a much larger private effort.

So those would be the three ones that I highlight first, ratepayer advocates, automakers and financiers, but everyone is welcome.

COMMISSIONER MONAHAN: And can you walk me through -- this will be my last question. That, you know, the Energy Commission is one entity that could help shape this, but there are others. Can you walk through what different levels of Government and outside entities and utilities you think could be, sort of be administrators of this --

MR. CRISOSTOMO: Sure.

COMMISSIONER MONAHAN: -- type of program?

MR. CRISOSTOMO: Sure. Sure. And if you go back slide five, that says how could TERPA

work. I'm glad that I put in the extra effort to assemble the diagram.

If you can share that slide, I can highlight that. We haven't determined who the program administrator is. But it really requires a close coordination among a diversity of program analysts, industry and funders of infrastructure. And the way to maximally leverage and unify our efforts, unify our front to take on big oil, is to collaborate in some still yet undefined way. But it really brings together state analysis, the Energy Commission's analysis.

CARB's analysis that tracks decarbonization targets, air quality team and targets. As Ben for LB&L will show, also the local governments. Like the air districts in So Cal that going beyond the Air Resources Board's requirements for zero-emission trucks.

And so that's a call out to stakeholders who have worked on our community blueprints and readiness plans, like the Port of Long Beach, as I described. Of course, the EVSP's will need to be involved to help design this, this program. And importantly, to back all this in data-ify the public investment, the utilities in their

administration of rate-payer funded programs, needs to be coordinated with our fee-payer funded programs under the Clean Transportation Program, which also could team up with cities, as we have seen CALeVIP, that support the program expansion in their local government.

And as you can see illustrated, workers are interested, automakers should be interested. This is really a hope to help unify all of our efforts so it's really collaborative, and advances as quickly and most efficiently as possible in reducing the public investment and making it most efficient to enable electric miles.

COMMISSIONER MONAHAN: Well, thanks, Noel. This is a really exciting proposal, and really appreciate your vision, and the fact that you are relentless in terms of exploring new ideas to advance transportation electrification. So thank you personally for all the work that you do.

MR. CRISOSTOMO: Thank you. And to create a concept, you know --

COMMISSIONER MONAHAN: Heather, I'll turn it over --

MR. CRISOSTOMO: -- to you have any questions.

MS. RAITT: I'm sorry. What was that?

MR. CRISOSTOMO: I didn't get my complete reply. So if anyone has questions, you can reach me at this e-mail.

COMMISSIONER MONAHAN: Excellent. Thank you.

All right, Heather, I'll turn it over to you now.

MS. RAITT: That's great. That's a multi-tasking background.

So thanks, Noel.

We're going to move on to public comment now. I see somebody has already raised their hand. So if you're on Zoom, go ahead and click the raise hand icon to let us know that you'd like to make comments.

And if you're on the phone -- somebody changed their mind. Anyway, if you're on the phone, press star nine and that will effectively raise your hand to let us know that you'd like to comment

And RoseMary Avalos from the Energy Commission's Public Advisor's Office is here to

help us with public comment.

Go ahead, RoseMary. Thanks.

MS. AVALOS: Thank you, Heather.

We have -- first I'll call on the attendee using the raised hand feature on Zoom. Please state your name and affiliation, and spell your first and last name. Also, do not use the speakerphone feature because we may not be able to hear you clearly.

Let's see. Lisa McGhee, your line is open, and you may need to unmute on your end.

MS. MCGHEE: Hi. I think I'm muted.

MS. AVALOS: Go ahead. Okay.

MS. MCGHEE: Okay. Thank you. Noel, I had a question for you. It's Lisa McGhee with actually Green Power Water Company, which is a new affiliation for my job.

And I had a question for you as it relates to more advanced integrated technologies in charging, which would obviously be two elements for medium/heavy-duty sector. One being voltage above 500, and wireless charging, which is certainly being integrated today in both luxury cars and for the medium/heavy-duty sector.

So how does some of this compliment in

your first presentation, some of the advanced technologies and standards for voltage at high levels?

MR. CRISOSTOMO: Sure. So critical part of -- is that a question related to the first presentation and the second?

MS. MCGHEE: The first presentation. Just because I think -- well, I'll let you decide. But my concern is just making sure that we're standardizing to support advanced technologies because that could be an issue if the charging doesn't have the right voltage, then you're not going to be able to support a vehicle at over 500 volts, which has become issues in deployments that have happened with standard DC Fast charging at 50 kilowatts.

And then, also connectors that would be integrated into vehicles today which don't void the connector, which is the J7272 plug, but would just be a compliment to both luxury vehicles which is available today, and then also in medium/heavy-duty vehicles.

MR. CRISOSTOMO: Right. So the CEC is working through a contract with NREL to test, because I mentioned, the high-power charger for

commercial vehicles, which exceeds the capabilities of the 350 kilowatt or 400 kilowatt liquid cooled CCS.

And so the objective is to serve commercial vehicles that require duty cycles beyond the speed at which they might be recharged with a CCS-1. And so they're designing standardized connectors for exactly that purpose going forward 10 times that speed, up to -- beyond the megawatt scale.

Yeah, that charging technology is still in process, but I think it's intended to solve exactly that problem.

MS. AVALOS: Okay. Thank you.

We'll move on to public comment with Stacey Reineccius. I'm sorry if I'm not pronouncing your name correctly. Please state your name and affiliation, and spell your first and last name.

Your line is open, Stacey.

MR. REINECCIUS: Hello. Stacey Reineccius with Power Tree Services. S-T-A-C-E-Y, R-E-I-N-E-C-I-U-S.

Noel, could you give an example or address how multi-family might fit within the

TERPA structure? As you know, 45- to 67-percent of residents, depending on their area in California, reside in multi-family, and we still have near zero penetration in support for people in multi-family.

So I'm curious as to how you see TERPA accelerating that, because I think that's critical if we're going to achieve the State's goals.

MR. CRISOSTOMO: Multi-family solutions is actually, it's one of the inspirations for the TERPA concept. Because what we're seeing is that there isn't a single solution silver bullet for multi-family charging. Obviously, you could go into every single building and construct that, and we understand there's a capital barrier to that. There's a renter turnover barrier to that.

And so the idea then critical to think about, okay, what about local DC Fast chargers that are shared in the street side in the neighborhood or at a grocery store, that people can frequent in an urban area. Or what about charging at work as a replacement to going into every grocery store going into every individual multi-unit dwelling.

And so the fundamental framework for TERPA allows for us to compare these solutions, very much compliments and competitors with each other, because they serve as compliments to EV's. They often serve in networks together as substitutes in fact.

And as long as we're able to find solutions that don't require major changes in behavior, that would be fair in any, any RFP that TERPA solicits. In essence, we would be able to compare kind of the fundamentals of the project.

How much energy would you be able to offer to your community or to your multi-unit dwelling network of users with your solution, and how much public investment would be required to de-risk a long-term investment in that solution. And so, those two parameters, potential energy and capability, are -- and the public investment requests, serve as the denominator and numerator of the basis for the competition, which is what it costs.

And so we are able to compare all the different solutions for infrastructure, including for multi-unit dwellings on a fair and a impartial basis. I hope that answers your

question.

MS. AVALOS: Thank you, Noel.

Our next commenter is Nicholas Johnson, And please remember to state your name and affiliation, and spell your name. Thank you, Nicholas. Your line is open.

MR. JOHNSON: Hi. You can spell my name, N-I-C-H-O-L-A-S, J-O-H-N-S-O-N. I'm an engineer at a company called Orange Charger.

Actually, to your question about MUD's, I'm curious on kind of what your approach is around there, kind of when you say installing, you know, DC Fast charging. Do you guys -- because something I was going to -- I wanted to get a sense for it. In your presentation, was where you get a lot of the data you guys were using to make these decisions, on do you have the data? Do you look at like where cars are being sold? And then how does that impact your disbursement of like your programs that you're working on?

MR. CRISOSTOMO: So I can attempt to answer that, but it really relies on some coordination work with other presenters earlier. Mainly, Tiffany, and her presentation on

disadvantaged communities and low-incomes deployments of infrastructure, in which we're examining that kind of geospatial distribution of these chargers and if there are ways to improve our access, our provision of access to those communities. But it also will rely on tools like EDGE, in which we're working with the Energy Assessments Divisions data sets for DMV registrations. So that's, that's something to come, but we can't really speak to it yet. That's, that's definitely on our radar.

MS. AVALOS: Thank you.

Our next commenter is Rajiv Shah. And please state your name and affiliation, and spell your first and last name.

Rajiv, your line is open. You may need to unmute on your end.

MR. SHAH: Okay. I think I think I'm unmuted now. Rajiv Shah, R-A-J-I, V, as in Victor. Last name, S-H-A-H. I'm with FreeWire Technologies.

And, yeah, I really appreciated these panels. I just offer these comments, kind of in a follow-up to a panel I was involved with on IEPR in June, involving sort of the scaling up

and attracting private investment to build out charging infrastructure. In that I think TERPA is a concept that FreeWire wholly supports, and it kind of gets at an issue that we've faced with sort of the bifurcated treatment of equipment subsidies versus make ready.

And, you know, we manufacture battery-integrated equipment that largely reduces infrastructure costs on the grid side of things, but the equipment costs more. And so the presence of just, you know, 100-percent subsidies through the utilities for make ready reduces sort of our business models by ability in many instances in California.

I think TERPA, you know, if its actualized, could result in sort of a more holistic consideration and a more cost-effective and beneficial expenditure of public funds throughout California. So I wanted to offer that there.

On the interoperability side, you know, at FreeWire we wholly support efforts to support interoperability. And I would, I would just say that for small businesses, and start-ups in particular, continuing to support our ability to

affect the interoperability standards, whether it's ISO 15118 or OSEPP standards is really important.

And so we appreciate programs like CalTestBed and the ViGIL solicitation concept in that -- to sort of help us be able to comply and compete with companies that have, maybe have more resources or are larger than us.

So that's all I had just some straight-up comments. No questions.

MS. AVALOS: Thank you, Rajiv.

Now we'll move on to the phone lines. A reminder to dial star nine to raise your hand, and star six to mute or unmute your phone lines.

Are there any other comments, please raise your hand.

Okay, seeing that there are no other raised hands, I'll go ahead and turn the mic over to Commissioner Monahan.

COMMISSIONER MONAHAN: Great.

Well, thanks to Micah and to Noel for their excellent presentations.

And, again, join us on Thursday. We're going to be doing more deeper dive exploration into some of the analytical tools that we're

using to assess California's progress towards building out a charging infrastructure sufficient to meet the needs of 5,000,000 electric vehicles by 2030.

So thanks everybody. Have a good evening.

(The workshop concluded at 4:15 p.m.)

CERTIFICATE OF REPORTER

I do hereby certify that the testimony in the foregoing hearing was taken at the time and place therein stated; that the testimony of said witnesses were reported by me, a certified electronic court reporter and a disinterested person, and was under my supervision thereafter transcribed into typewriting.

And I further certify that I am not of counsel or attorney for either or any of the parties to said hearing nor in any way interested in the outcome of the cause named in said caption.

IN WITNESS WHEREOF, I have hereunto set my hand this 10th day of December, 2020.

MARTHA L. NELSON, CERT**367

CERTIFICATE OF TRANSCRIBER

I do hereby certify that the testimony in the foregoing hearing was taken at the time and place therein stated; that the testimony of said witnesses were transcribed by me, a certified transcriber and a disinterested person, and was under my supervision thereafter transcribed into typewriting.

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I certify that the foregoing is a correct transcript, to the best of my ability, from the electronic sound recording of the proceedings in the above-entitled matter.

MARTHA L. NELSON, CERT**367

December 10, 2020