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JOINT STAFF WORKSHOP OF THE CALIFORNIA ENERGY COMMISSION

AND PUBLIC UTILITIES COMMISSION

In the Matter of:	)	
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CALIFORNIA ENERGY COMMISSION

CHARLES IMBRECHT ROOM - FIRST FLOOR

1516 NINTH STREET

SACRAMENTO, CALIFORNIA

WEDNESDAY, DECEMBER 7 2016

10:00 A.M.

Reported by:

Kent Odell

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AGENDA

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P R O C E E D I N G S

10:22 A.M.

SACRAMENTO, CALIFORNIA, WEDNESDAY, DECEMBER 7, 2016

CHAIR WEISENMILLER: Good morning. I guess we don't have to go through the normal announcement about if there's a fire alarm.

But anyway, so anyway, as I said, with the shift of stuff, I've got to come in, make some comments, and head off to my 10:30 meeting. So I appreciate your flexibility on this.

I think the basic message is that California overall is leading by example. And in terms of dealing with showing it's possible to have a sustainable economy, growth, and at the same time, reducing greenhouse gas emissions. And so that's bottom line. You know, as I said, we're one percent of the world's greenhouse gas emissions. So in terms of if you take it to zero it's not really going to affect the global situation as much as what we can do by example.

And in California, and this varies throughout the world, the transportation sector is our largest source of greenhouse gas emissions. And so reducing emissions from this sector is really critical to getting to our, you know, 2030 target, 40 percent below, and then getting to our 2050

target. And, you know, certainly one way we see to reduce emissions in the transportation sector, and as I said, this is almost 40 percent, so it really dominates our inventory of emissions, and it really has to dominate where we look for solutions.

Good morning, Commissioner Peterman. Hi.

And so the way we're doing that is an expansion of electric vehicles. And we're investing in charging stations across California, particularly thanks to the recent decision of the PUC, among other things. And we're looking for ways to really expand the opportunities for electric vehicles or electric transportation in disadvantaged communities. Again, it's really critical that all Californians share in our programs to really address climate change with clean technologies.

At the same time, we really need to figure out ways to make these electric vehicles and opportunity to deal with some of the grid integration issues. So that means we really need data and communication standards to ensure that the grid is prepared to handle charging millions of electric vehicles at affordable rates, and at the same time for these electric vehicles to really help smooth how the electric grid is run.

You know, I'll just note, yesterday I was at 29 Palms, talking to the Air Force about their really

pioneering experiment down at the L.A. Air Force Base. And one of the things we've recently discovered is that their data doesn't match the billing data on, you know, what value they provide it, when they provide it, and what the costs are. So that's something which the ISO is starting to dig in at this stage. But again, it really illustrates the importance of this workshop, that to the extent they're really trying to provide value to the grid, you know, we've got to get the numbers right.

So anyway, thanks for the interest. Hopefully we can get to a better space for this exercise. But, you know, and I certainly appreciate everyone's interest today, so thanks.

MR. CRISOSTOMO: Thank you, Chair Weisenmiller. Again, sorry for the snafu for the fire drill. And obviously, your interest is overwhelming physically. So when we do hear back from Mike, who I think is looking into how Rosenfeld might accommodate us, we will try to make do as well as possible.

For the CEC staff here there is a WebEx being cast live. So perhaps to accommodate some of our guests that have come, please consider joining via the WebEx. I really appreciate everyone's flexibility.

So given those introductory remarks, we'll have to kind of shift everything half-an-hour. And I did build in

time at the end for public comments, so hopefully you won't need to change your schedules very much. But again, this is the beginning of a process to learn about how we can integrate vehicles, millions of vehicles into the grid effectively. And so let's go through the agenda and again, just add 30 minutes of time, roughly, for each of those segments.

Today is split into three parts.

And I guess I should introduce myself. My name is Noel Crisostomo. I'm an Air Pollution Specialist in the Fuels and Transportation Division at the CEC. Many of you might have seen me last at the Public Utilities Commission, where I was a Regulatory Analyst working on electric vehicles. I'm glad to be sharing the stage with some of my colleagues and our state's leadership in both transportation and decarbonized energy here today.

So today's split into three parts. First, to introduce California's goals and needs for vehicle grid integration and the policy actions that are taken to pursue effective integration. To that end, we'll have opening remarks from our leaders here to set the table for California's interest in widespread transportation electrification. And subject matter experts from the PUC, ARB, Independent System Operator will join me in explaining what the state has been doing to enable vehicles to become

distributed energy resources.

The middle part of the day is focusing on what we can learn as the state and as industry from each other. We have representatives from the electric, automotive and charging sectors, with decades of experience building, designing and deploying products that are capturing the imagination of customers with new technologies and models, and in increasing frequency. It seems like some new product is coming out every week.

Communications and controls are one of the most esoteric subjects that I have spent time on in my brief energy career. And so I wouldn't expect everyone in this audience to understand the particulars of every slide. However, these technologies are the foundation of enabling vehicles to become resources for our networks. And we can enable them to become grid assets, instead of liabilities, all, meanwhile, not jeopardizing customer confidence that they can get where they need to go.

We're glad to welcome these experts that are providing presentations, and you in the audience to provide your perspectives. Because we have so many people from different backgrounds, I'd like to ask that our experts keep discussions targeted at perhaps the 3,000-foot level, not the 3-foot level, because standards are extremely complex. And we will have plenty of time for discussions here and in

a proactive implementation process that my colleague Amy Mesrobian from CPUC will be going into in detail in a few minutes.

The third part of the day is framed as setting our pathway to 2020. We are a little more than three years away from the deadline that Governor Brown set forth for us in his 2012 Executive Order, calling on the state agencies to pursue actions that would deploy grid-integrated infrastructure that supports 1 million zero-emission vehicles.

To ensure that we're on task to meet this goal, this session starts with a perspective from Frances Cleveland, who, with direction from the CEC and PUC, helped transform the DER industry with her efforts in chairing the Smart Inverter Working Group. We'll then have time to explore questions around strategies to facilitate these private investments, and where additional state efforts and financing or funding can support the industry.

I hope everyone was able to pick up a discussion prompts page next to their agenda, so take a look at those throughout the day.

These discussions will be the basis of your feedback so that we can create and implementation strategy that timely electrifies our transportation sector, which accounts for 80 percent of NOx and ozone emissions, and 40

percent of our state's greenhouse gases.

And so while the day is packed, about now 90 minutes of time will be available to you for feedback. And I'll do my best to keep myself and my fellow presenters on time so that we can facilitate that.

Along those lines, I'd like to reiterate that since these are technical subjects that go down rabbit holes quickly, we need to set ground rules to use our time efficiently.

To that end, use the Q&A time after people finish presenting, as noted on the agenda, to ask technical questions because they might get to your point during the presentation itself.

Second, our Public Adviser will be helping me out during the public comment periods, as indicated. Please take and -- well, maybe since this is so full, we'll have to rethink the blue card part.

Oh, excellent. Evacuate again please.

(Off the record at 10:37 a.m.)

(On the record at 10:46 a.m.)

MR. CRISOSTOMO: Let's get restarted.

So for Q&A, just ground rules. During the facilitated discussion slot, the questions that you have in hand are broader and more intended to be brainstorm-type activities or brainstorm-type issues to talk about to spark

ideas on how we can work together through this process. So as a logistical matter, please, when you're speaking, introduce yourself and your organization, raise your hand, wait to be recognized, and use a microphone so that everyone in the audience here and listening remotely can hear you.

Now to get back to more welcome and purpose from our state leadership, Commissioner Peterman, I'll hand it off to you.

COMMISSION PETERMAN: Good morning. Thank you, Noel.

Good morning everyone. I don't know about you, but the excitement of the morning has only heightened my anticipation for the day's activities.

For those of you on the line, we were in a smaller room. And so people were bursting at the scenes. People were waiting to get into the room to talk about communication standards. And I hope that that excitement persists, not only through today's workshop, but through the various proceedings and forums our different commissions and entities have in 2017.

Most of you are aware that in September, I issued a ruling providing direction to the investor-owned utilities regarding what to file in their transportation and electrification plans as a part of SB 350. One of the things included in that ruling was our staff recommendation

that the utilities describe how their infrastructure investments will align with ISO 15118 standard, or what, otherwise, what would be an appropriate communication standard or protocol to utilize or to associate with their investments.

Since I issued that ruling in September, there has been a tremendous amount of interest, not only in what is going to happen in the plans, but particularly around what we're going to do around standards. And understandably, there are a diversity of views from expert people. And I look forward to having the conversation with all of you over the next several months about what we should be doing in the upcoming plans, as well as a long-term, how as a state should we be organizing to think about the value of communication standards, particularly for promoting vehicle-grid integration.

There are some who feel it's too early to be having this conversation, and that we should not be further exploring putting these requirements in place. I disagree with that perspective for two reasons.

One, we have clear direction from our legislature and our governor to scale and make mainstream transportation and electrification. If we're going to have infrastructure for a million vehicles on the road in 2020, that infrastructure needs to be so that it can provide all of the

services we want from electric vehicles, not only those services that we can identify in the next year, but those services that we're going to want in ten years.

Those of us who work in renewables have spent a considerable amount the last few years figuring out how to improve, for example, distributed solar generation so that it can meet our system needs and support the grid. Think about how nice it would have been if we had done all the work on smart inverters and interconnection and ancillary services with DG before the systems were deployed. I want to avoid that here with transportation electrification. If we know what we want these vehicles to do in the longer term, let's start talking about what are the protocols that can make that happen.

The second reason we need to act now is that California has and will continue to be a leader in this space. Yes, it would be nice if every country in every state was deploying electric vehicles at the same amount and rate that California is, but they're not. And so we do want to be consistent with what's happening internationally but, also, we're going to need to lead. And so if we do think that there are some benefits to standardization, I think this is the place to implement those practices.

I fully appreciate that before we pursue vehicle-grid integration with earnest, we need to have the vehicles

and the products in place, and there are investments that are happening all over the state to ensure that.

What I'm looking for today in the workshop, I'm looking to understand, what is the VGI product that we're working towards? How do communication standards help us better access? If it is premature for standards, then what types of steps do we need to be taking to position us to better understand when those will be needed.

This conversation will extend beyond today. At our Commission, it will be in 2017. But I tell you, we're going to be making rulings and decision related to this topic sometime in 2017. So I appreciate everyone rolling up their sleeves and doing the hard work to position us to be at the front of this movement.

Thank you.

MR. CRISOSTOMO: And now standing in for Cliff Rechtschaffen, Tyson Eckerle from the Office of Governor Brown.

MR. ECKERLE: Thanks very much, Noel. And I'll keep my remarks brief because of, well, the excitement of the morning, for one.

But really, we're here because this is really -- this is important. And we thank everybody for making time to come up and share their day with us to talk about the VGI and communications standards. If we get this right, I mean,

it really has the potential to open up the market. It can, you know, marry our increasingly clean grid to transportation. I think there's a tremendous amount of opportunity there.

And we really want to commend the Public Utilities Commission for advancing this conversation. I think that Appendix B really kind of forced us to get in the room together and really talk this through. And I think we've been talking to a lot of people in the lead-up, and I think there are lots of different opinions. And I think we're very eager to hear those opinions and figure out how we can work together to get to those optimal solutions. And I think there might not be just one solution, and I think that's part of the excitement of it.

Thanks to the Energy Commission for organizing the day. And really, as we look forward, California being the largest plug-in electric vehicle market or zero-emission vehicle market, we have the opportunity to set the course. And so I think it's really important that we work together to get this right.

And we need you, the stakeholders, to help make sure that we have the right people in the conversation with this, and I think that's really important, so we'll be looking to you to do that. And I think I'm imagining a lot of the people are in the room, but there are probably some

people who aren't in the room that we need to make sure we bring in. And I think today underscores the importance of working with all stakeholders. You get all the voices in there and really set the groundwork and framework for how we can make VGI be a critical and important piece of our transition to a fully zero-emission vehicle fleet.

And so I'm very much looking forward to the conversation. And thank you, again, to the agencies and to everybody here whose shared their time with us. I'm looking forward to it.

MR. CRISOSTOMO: And substituting for Commissioner Scott, who has an alternative appointment, we have Matt Coldwell from the Commissioner's Office

MR. COLDWELL: Thank you, Noel.

So Commissioner Scott sends her apologies for not being able to be here today. And so I'm going to be just really extremely brief.

So she asked me just to convey that as the Lead on Transportation here at the Energy Commission, today's topic is of great interest to our office. And so we're really looking forward to both the discussion that we're going to have today, and then, of course, continued engagement with all the stakeholders moving forward over the next few months. So I appreciate everybody's participation today, and looking forward to a great discussion.

Thanks.

MR. CRISOSTOMO: So as we transition to California's activities, I'd like to invite my colleagues, Amy, Stephanie and Jill, up to the other three seats, so that we can transition effectively during our separate parts of this presentation.

The Energy Commission, Public Utilities Commission, Independent System Operator, and Air Resources Board have been working together for roughly the past three years in implementing research projects, sharing learnings, processes, initiatives, so that we're all on the same page around VGI and what each agency is doing. And this VGI Interagency Working Group is a key element of moving this process forward together to ensure that our products, that we are designing across agency silos, ensure that the market is efficiently moving forward.

So I will give context, and Amy will provide an overview of how we got here, describing the PUC's process. But this is what we're hoping to cover during this presentation. We will describe the context and policies to decarbonized transportation in more detail, including SB 350, and the imperative for VGI in terms of the dynamics that we have been observing in the market as it is growing. We'll identify how to solve grid challenges, now and in the future, given what we are observing on the system, and

explain from the different agencies' perspectives and efforts why VGI is valuable to the State of California.

As Commissioner Peterman mentioned and as Amy will detail, one option to consider was proposed in the CPUC's rulemaking to communicate PEV data, which was the ISO 15118 protocol. But going forward, we do have continued policy and regulatory needs to seek your feedback so that we can have an informed and timely process to decarbonize our transportation system.

So with that, Amy?

MS. MESROBIAN: Okay. Thank you everyone. My name is Amy Mesrobian. I'm an analyst with the California Public Utilities Commission. And just in the interest of this being the first workshop on this topic, I just want to provide some regulatory context for why we're here today.

So in SB 350 there were some directions to the CPUC and the utilities regarding transportation electrification. And so SB 350 required the CPUC, in consultation with ARB and CEC, to direct the investor-owned utilities that we regulate to file applications for programs and investments in transportation electrification. And so the objectives of all of these applications and investments are to reduce petroleum usage, meet air quality standards, improve public health, and reduce greenhouse gas emissions. And so we'll be looking at all these applications and

making sure that they're delivering all of the emissions and grid benefits that they should for the legislation.

Can you go to the next slide? Thank you.

So once SB 350 was signed, the CPUC started the regulatory process to think about what that meant for us and how we would work with the utilities to do some implementation. So we began our public process in March of 2016. We continued with a workshop, which I'm sure many of you were at, and also got a lot of public comments. And through that process we heard from a few folks on the issue of vehicle-grid integration standards.

And as Commissioner Peterman mentioned -- actually, can you go to the next slide -- in her ruling from September, she discussed the issue of vehicle-grid communication standards, but also acknowledge the fact that the record that we had to date that was comprised of party comments, there really wasn't enough information in the record to make a decision one way or another, if we need to adopt one or any standards to help support vehicle-grid integration. And so the ruling asked for the utilities to talk about how they would meet the ISO 15118 standard, or to propose some alternative recommendation for delivering VGI value.

And, so sorry, can you go back a slide? Okay.

So for 2017, we're anticipating -- or the

utilities will be filing applications, starting next month. And as we review these applications, we also want to think about how we can consider this issue of a VGI communications protocol as we're reviewing all of these utility applications. And so the ruling called for some information in the applications to talk about a possible communications protocol.

But we also want to think about what's really the best way to get all of this technical information into our record. How do we have all the discussion? How do we include all of the stakeholders that we need to include in this conversation?

So one idea that I want to share from the CPUC for feedback from all of you today is the idea of doing a working group around vehicle-grid integration communication standards or communications protocols. And the objective of the working group would basically be to have, you know, a narrow set of objectives. And the working group would help talk about which, if any, standards the CPUC and other state agencies should adopt to support VGI and maximize the benefits that IOU and other state investments bring in transportation electrification.

So we thought the workgroup might be a good idea because it could run in parallel to our regulatory process, but it could really allow people just the time to dive deep

into this issue because it is really technical. I can just say for myself, I'm just starting to learn about it, and I think a lot of people are in the same situation, as well.

So that's something that I'm hoping that we can get your feedback on throughout the day, if that seems like a viable alternative, and if that's something you'd like us to pursue as we work with the other agencies on this issue.

And so, yeah, that's the main thing that I wanted to convey, just that this is -- we see this as the starting point of the discussion. And we'd like to make sure we have the appropriate vehicle to continue the conversations that you all think need to happen.

COMMISSION PETERMAN: Let me just add one additional comment, Amy. Thank you for your thinking on this topic.

With regards to a working group, I am interested in how we can structure a working group and make the focus so that it can inform decisions we're going to issue in 2017 regarding the first transportation electrification plans. So there's still that guidance which still persists that's in the ruling.

But the idea of the working group as a mechanism to further assist our understanding to be able to evaluate what comes before us, as well as to consider issues that may not be brought up by the parties that typically weigh in to

our more adversarially-natured proceedings, but again, to be structured.

Thank you, Amy.

MR. CRISOSTOMO: So to ground all of that action in 2017 in a distinct time frame, in a structured manner, I'd like to remind everyone what transportation electrification is meant to accomplish.

During COP 22, California reaffirmed its commitment under its Coalition for Under Two Degrees to do its part to mitigate climate change. Recently passed laws, like SB 32 and AB 197, require the state to reduce its emissions 40 percent below 1990 levels by 2030, and on the way to 80 percent by 2050, as referenced in SB 350, and to protect our disadvantaged communities from the impacts of climate change that are already in the pipeline.

We are already observing unprecedented losses in our forests, record-breaking temperatures, and potential instability of our cryosphere. So we do have to act and take a leadership position.

VGI takes this challenge head on with a dual-purpose technology. It enables customers' mobility to become an integration resource by intelligently managing and charging -- managing charging to smooth the variability in renewable generators, while also avoiding the need to harden our grid.

I'm referencing three point -- three key reports here.

First, the VGI Roadmap, which was published shortly after the PUC launched its 2013 rulemaking directing the utilities to help facilitate this technology.

Safeguarding California, which in 2015 set goals for the transport and electricity sectors to use automated and modernized data to protect our vehicle and infrastructure systems from climate change.

And third, last October the Governor's Office updated the ZEV Action Plan and tasked our agencies to specifically, one, ensure technology research is coordinated with the development of standards, procurement policies and tariffs, two, to ensure vehicle interactions with the energy system are harmonized across utility territories, and three, to ensure that ratepayer investments return maximum benefits to our grid.

Last November the PUC continued its work on AB 327 which defines EVs as a distributed energy resource, and put AB 327's efforts in context of its other proceedings.

The DER Action Plan sets a vision for wholesale market integration of DERs, including electric vehicles, where charging and mobility behaviors can be predicted and overseen within grid operations, and to ensure that market rules solving resource registration, utility interconnection

procedures and physical connectivity, given that these resources are ultimately mobile and moving across power systems, to remove those barriers and to ensure that vehicles can participate in grid services freely. The key to achieving this vision is bringing the learnings from our research investments into policy.

Why is this critical now?

VGI is needed as policies are -- agency policies are being reinforced by market innovation. And we don't really know how widespread electrification could be adopted. On one hand, CARB's Cleaner Technologies and Fuel Scenario, which is the closest proxy for SB 350 and SB 32 compliance, estimates that by 2030 there will be around 4 million ZEVs and PHEVs, which is pretty much 16-fold compared to where we are right now.

But in a different study, by that time, Bloomberg & McKinsey identified that mutually-reinforcing advancements of batteries, the internet of things, urbanization, and the growth in mobility-as-a-service could have fleets in certain areas, two-thirds electric vehicles and 40 percent autonomous.

These trends require California to be proactive in ensuring that the infrastructure that we deploy, especially in areas of high demand, and could be -- to be responsive to unexpectedly large loads. We don't want to hinder

reliability and prematurely require grid hardening. And so critical to this is solving our supply constraints with customers mobility needs.

The EV manufacturers, charging providers, and utility companies have responded to the state's call to action in pursuit of the ZEV goal. Each of these actors, utilities, automakers, and charging providers, are critical to achieving the optimization at scale, principally because everyone has different competencies and data that they collect, and therefore insight on that information which form the lifeblood of their operations. Utilities know how the grid works. Automakers know how cars operate--they create endearing and evolving customer experiences by serving them upgrades periodically. Third, charging providers analyze how their networks function, and keep them online and reliable.

One common thread throughout these actors is their ability and potential to indirectly or directly control vehicle charging.

In my observations in the market, however, this common potential for load control is causing these actors to compete for what a former colleague and I termed "the resource" in the VGI White Paper from the CPUC. This resource is getting pulled apart by efforts by every one of these entities. However, the competition that we're seeing

potentially is not appropriate, because EV charging does not exhibit the characteristics of a perfectly competitive market, especially amongst these three actors.

To generalize, these actors, in some parts, in some manners are disincentivized from sharing this data. However, harmonizing their individual data sets is very important because solving for that optimization of grid needs, customer needs, and network operations is incomplete without all three.

What has occurred is potentially a fragmentation of the actors' objectives that we have described in the White Paper. Technologies have been developed that, if implemented incorrectly, have the potential to risk customers' mobility. For example, vehicle and charging station emulators, EVSEs that can override proprietary automotive telematics, and algorithms requiring end state of charge as a user input without asking for the requisite information on their battery size. That is extremely concerning.

And so we have two options potentially at this point. Two pathways: a vicious one or a virtuous one. We want to head to Destination B where we have eager and renewably charged electric vehicles with VGI-ready vehicles and charging stations that are scalable and resilient to changes in technology.

In order to provide this pathway, in Appendix B the Energy Division provided 11 criteria for standards, and we'll be discussing these in detail throughout the day and in the next slides. I won't reiterate every one of them here, but I'll focus on scalability at different parts of the grid.

We know that renewables are requiring more flexibility. But an interesting point that I've read recently was that the duck has hatched potentially sooner than expected, and it's bigger than we expected, than the ISO expected.

In 2016, March, the net load was 14 gigawatts, which approximated the CAISO's estimate in March 2017. The minimum net load decreased roughly 25 percent between 2011 and 2015, increasing over-generation risk. Afternoon ramps are getting steeper. And the number of days of a four gigawatt ramp quadrupled between 2011 and 2015. The maximum ramp during that time frame increased 61 percent.

Day-to-day operations are changing. The average weekend three-hour ramp is ten percent steeper than those during the weekdays. Further, these are changing operations year-round, not just during the spring when the curves were anticipated.

Lastly, the analysis found that managing the ramps required large enough resources to be visible, and

participating at the system level.

This is kind of a telescoping figure that goes into the different levels of the grid that we have to be optimizing for. At the ISO's sub-lab level, given generators around, we can see that, kind of understandably, solar plants are causing the highest amounts of over-generation and causing negative pricing.

If we go down deeper, at the distribution level in PG&E's territory with their DRP analysis of integration capacity, you can click down to a feeder and see their estimates of integration capacity for vehicles could increase almost nine times by using an EV-specific time-of-use rate. But the challenge here is that system needs often conflict from distribution needs. And while the PUC is working on changing time-of-use rates to reflect wholesale system operations better, those -- that alignment is key but isn't sufficient for vehicles at scale.

As we transition to default time-of-use rates for those investor-owned utility customers by 2019, TOU rates that are designed for entire customer classes are not scalable. First, consider that less than 40 percent of the 250,000 EV drivers use TOU rates. If they all plug in a three kilowatt charger as soon as the arrive home, these vehicles could be exacerbating the ramp that is continuing to steepen, estimating maybe 450 megawatts of chargers on

peak today.

In terms of the wholesale-retail rate alignment, customer-class TOU rates will simply shift the power delivery constraint from system generation to local distribution. And while line and service upgrades that are needed estimate less than a quarter of one percent of EV drivers today, we have to address the local transformer constraint.

With flat or declining residential peak demand, given that EVs are adopted in clusters, these charging loads might overwhelm the freed capacity of the declining residential load. Singly-metered PEV customers have increased 1.1 kilowatts over five years, and that's a trend that will likely continue as automakers deploy higher power chargers.

So given that the grid is seeing different needs, we need to understand how the value of VGI is changing. And understandably, these evolving markets potentially pose risks to the actors. A variety of institutes and consultants have come up with VGI evaluations to assess the current market. But it is exactly -- it is difficult to exactly quantify the value of marginal technology investments, due to the dynamics of different domains.

So furthermore, new markets, maybe at the distribution level, have up to this point necessarily

required long regulatory processes which cause uncertainty in decision making. However, I'd like us to focus today during our discussions on the strengths and opportunities that we can take advantage of to avoid stagnation.

First, how can we leverage the thesis of VGI, which ultimately is a dual purpose to carbonization tool, to achieve net benefits for the state?

Second, how are technologies, power technologies critical to VGI, changing in costs?

Third, do automakers' strategies and investments in stationary storage face similar risk? And what is motivating them to deploy stationary storage?

And fourth, what are the general trends and value related to location and speed or delivery of wholesale and distribution grid services? And what are the technical equipment validation and other requirements that we can identify today and move forward on?

To illustrate the point of how California values VGI beyond the value of grid services, this is an illustration of almost a dozen agencies working together to gather ZEV data. I won't read through all these here because we've docketed this presentation, but it ranges from charging authentication, low-carbon fuel standard credits, planning for infrastructure, load forecasting and grid planning, ultimately allocating costs of construction to

electric vehicles, given that we can't live off of the gas tax forever, and it goes on and on. But there are greater values for this data than just grid services to the state.

And to provide examples, I'll head to Stephanie and Jill to talk about ARB and CAISO's efforts.

MS. PALMER: Hi. I'm Stephanie, and I'm here today to talk about Senate Bill 454, also known as Electric Vehicle Charging Open Access Act. This Senate Bill deals with how users interact with the charging stations and their vehicles to transfer billing information. It was signed in 2013, and it states that if no national standards were adopted by January 1, 2015, ARB has the ability to adopt a national standard to set up these four requirements. One, all publicly available EDSCs, you can access, regardless of being a member. Two, all fees must be disclosed at the time of sale, including plug-in extra charges, along with the kilowatt hour charge, multiple forms of payments methods, including credit card and mobile technology, and the location and payment information per site will be transferred to NREL.

Next slide.

So how are we -- what is our timeline?

Currently, we are interacting with network providers and EDSEs' manufacturers to see what the market is at right now and how are users today interacting with the

charging stations. We are establishing working relationships, and we look forward to convening workgroups to discuss this further. And we are going to be pursuing a regulatory approach because it will help us structure all the needed documents and guidance materials we will need to implement SB 454. Thank you.

MR. CRISOSTOMO: Thanks, Stephanie.

MS. POWERS: Okay. Hello. I'm with the California ISO's Smart Grid Technologies and Strategies Group. And I would like to thank Noel for really laying out and highlighting the evolving reliability issues that the ISO faces, and the need to have these types of operational tools to mitigate these operational issues that we believe we're going to face, and really wanting to have those operational tools to be within the market and to resolve them through the markets.

So we're very excited about this interagency workshop and the work that's being done on standards, because the ISO is very supportive of standards that would help facilitate and enable electric vehicles to participate and provide in-grid services. Some of those grid services can be provided through economic market dispatch. This would require standards that would provide scalability to the level of participation that is required to participate in the markets, also to provide capabilities for control.

We have our day-ahead markets that would only be providing a 24-hour notification and hourly participation.

But then we also are looking for that real-time market participation where notification could be only up to five minutes notification, and response to be modulated every five minutes. So we're really looking for these fleet control capabilities for the availability of this capacity to respond to ISO dispatch.

We're also looking for the provision of ancillary services. This would require telemetry, visibility of the capacity that we have available for these services. So that is one thing that the standards might be able to affect and effectively facilitate.

Also, we have opportunities in the markets for response of -- frequency response through our automated generator control markets through our regulation markets. However, we're also looking at these standards as potentially providing autonomous response for frequency. Okay.

So the ISO has been evolving policy, as well as market-participation models, to reduce the costs of participation and recognized capabilities of advanced technologies, electric vehicles being one of those. So for the past several years we've been looking at our

requirements, requirements in things such as metering and telemetry, and working on expanding those options for meeting those requirements, as well as we've been working in the last couple of years, throughout 2015-16, on expanding metering telemetry options that created a distributed energy resource provider framework. And this allowed for the aggregation of distributed energy resources.

Most recently, we've been working in energy storage, and also, again, advancing enhancements to our modeling capabilities for distributed energy resources and how we measure and evaluate these distributed energy resources through our energy storage, we call it our ESDER initiatives, which we completed in 2015 under Phase 1. It was implemented in 2016. And now we are moving forward on further advancement of these policies in ESDER Phase 2, which will be looking for implementation in 2017.

I did want to highlight that most recently the Federal Energy Regulatory Commission has extended concepts from the ISO's Discharge Energy Resource Provider Initiative. And they're extending this nationally in a recent issuing of NOPER (phonetic), making this a requirement for other ISOs and RTOs. So we've really set out a framework that is being looked at nationally to facilitate participation of distributed energy resources.

MR. CRISOSTOMO: Thank you, Jill.

And so as California starts to proliferate its ideas nationally, I think it's also important to realize that while we're at the head of the spear, there are ample opportunities to learn from international efforts.

Consistent with Governor Brown's calls in his release -- in the announcement about the Scoping Plan, he reiterated points "to scale" and the need for "broadening collaboration", where California can build its policies upon the learnings from other PEV markets throughout the world, as they've faced similar grid reliability problems due to renewables and interface problems in charging infrastructure. So as appropriate and conformable, California can scale based on others' experiences and best ideas, as identified by the ZEV Alliance in terms of policy principles and technologies.

There are three examples here that you can read more in depth about in the links below. But there is a base of intellectual knowledge that we should be jumping off from.

An example of this is the European Union's Seventh Framework Programme for electric vehicles. And there are at least 21 relevant and recent policy, technology and economic assessments just on vehicle grid integration. This table has links that I encourage people to explore, as we start off on this path. And critically, there are some examples

of analyses across different scenarios, conservative, pragmatic, advanced, looking at the appropriate technologies across the different domains that Frances and our other experts will be talking about today, and economic assessments of the value of investments.

So one example from Europe's PlanGridEV study was that for roughly less, a little bit less investment, a smart grid could integrate more renewables cheaply and be operated more cheaply.

One option that was identified in the PUC's Appendix B was the ISO standard, which was developed jointly over multiple years at the ISO and IEC. And I'm sure many of you have been engaged in this process. It utilizes a consensus-based negotiation of numerous global expert stakeholders. And it continues to evolve to potentially enable future use cases, like V2G, wireless chargers, and bus chargers. It is embedded and is based off the Combined Charging Standard, which is widely supported by many automakers.

To put IEC 15118 in the context of California's DER system, I'm stealing a slide from Frances which she will elaborate upon later. But Rule 21 reform, which was the purpose of the Smart Inverter Working Group, covered these three bolts: between the utilities' DER controller to the DER, a facilities load management system, or an aggregator's

load management system. 15118 establishes the DER as this connection of the charger and the car. And there are other standards that exist in this realm, including OCPP, which is Bolt 5, which is in development, and SEP 2 which is the default communications protocol for Rule 21.

And so as we look forward, we need to critically ask, how should California protect its scaled seven investments?

This is an example of all the accomplishments that we've had in the past three years and the criticality to act now. As we're working together to inform the utility applications and other investments, we have to understand that in the next several years there are two major forces. First, potentially the release of many vehicle models, both battery and plug-in hybrid by the automakers. And the utilities will be embarking upon, potentially on the high side, five-year infrastructure deployments under SB 350. This doesn't have -- we don't have a lot of time between now and our pretty challenging goals to reduce NOx emissions in the South Coast 80 percent by 2023. And as we go forward with higher renewable power goals and in the interim, the deployment of 1.5 million ZEVs, now is the best time to act.

And so in closing, we're requesting your feedback on how we can progress on VGI. California's energy and environmental agencies could act to provide a consistent

market signal that prioritizes the protection of the state's investments. We're responsible for ensuring that technologies employed in our vehicles work harmoniously across service territories, while ensuring that wasteful and uneconomic energy consumption is avoided. We can achieve our vision for integrated zero-emissions transportation. And we think that standardization in concert with other efforts could be utilized as an accelerant to the adoption of electric vehicles by establishing interoperability, improving competition, decreasing costs, and simplifying the customer experience.

So in closing, we welcome your ideas and want to ask, how do we electrify transportation with a grid-integrated infrastructure by 2020?

And we'll have around ten minutes for feedback. No feedback? Yeah.

(Off mike.) All right. I'll bite.

MR. CRISOSTOMO: So just raise your hand, I'll identify you. So Steve, Anne, and then Urvi.

Go ahead. So please stand up and -- yeah.

MR. DAVIS: Is this on? Okay. Yes, my name is Steve Davis. I'm the Founder of KnGRID.

And to Noel's point, you know, there's an old riddle that Boone Pickens likes to ask, and he says, "When is the best time to plant a tree?" And the answer is 20

years ago.

We have been engaged in this discussion about standards, with all due respect to Amy, that this is not the beginning. We have been engaged in this discussion for years now. And the way that we can, I believe -- I've got a lot of friends from the OEM community here in the room, and I know them and we talk a lot. And after 6:30 we're all friends, but we do have some debates and discussions about these things.

A common unique standard -- and, Carla, I think we were in this very room two-and-a-half years ago, having this very conversation -- a common unique standard is how you get it done. And it sends the OEMs what they desperately need, which is a market signal of what to build.

I think you were wise in your ruling, and your subsequent ratification of that ruling to a decision, in the sense that what you did is you created a market signal that is uncontroversial. If we look at the comments of the parties in that rule-making proceeding, that was the common thread, ISO 15118, that we saw. There may be some frustration from some of the OEMs that that ends up being the ruling. I think that's a minority group of OEMs. I think the majority is already implementing 15118 for DC fast charging. So we should -- I don't want to blow all the thunder for the presentation I'm going to make later. But

ISO 15118 supports the CCS standard for DC fast charging already. And the OEMs are by and large, the vast majority of them are implementing that standard.

So it's a pretty short throw for AC Level 2 smart charging because it uses the very same communications software stack, as well as repurposes the PLC modem that's already on the vehicle. I'll flesh this out a little bit more.

But there's a joke about standards, too. The great thing about standards is there's so many of them. That's the worst thing we can have, is more fragmentation. And I'll give you a quick example.

Suppose I am lucky enough to buy a Mercedes B-Class electric vehicle. I don't have one of those. They're a little out of my range. But then I drive to my uncle's house, and he's really wealthy and he's got a Tesla. I need to refuel. I can't use his charging station. And there we have a perfect distillation of let a thousand flowers bloom and not get right with the essential ingredient in broad adoption of electric vehicles, which is to simplify that. One question, whenever I talk to somebody contemplating an electric car, I get -- the same thing comes back to me every single time, well how do I refuel? How does this happen?

So that's what I would say as to how we can accelerate is to send that market signal, make it clear. I

think that my OEM friends that get allergic about this kind of thing will say just let the point of regulation be the charging station. Please don't force us to do anything. Let us do it at our pace.

Thank you.

MS. SMART: Hi. Anne Smart with ChargePoint.

The slide that you had up on Rule 21, could you clarify some of that process? It's been very difficult for us in the industry to track these Smart Inverter Working Group, given that the charging station section has come in and out of proposed scopes in the various phases. So we've participated in meetings and then been told that it's not in the scope. And so we stop, and then it gets back in the scope.

So it would be helpful to understand, particularly the -- you reference, I think, the number three bolt and the number five bolt, what is established and what is still in the process as it relates to today?

Thanks.

MR. CRISOSTOMO: So I'll defer to Frances to answer that question, maybe during the afternoon. But just as I understand it, and I'm still getting up to speed on the Smart Inverter Working Group, Rule 21 exists in these three bolts, so IEEE 2030.5 defines the default communications protocol in these three areas between the utility comms with

the aggregators comms, a facilities comms, and the DER's comms. So that's the realm of 2030.5.

But the proposal from Energy Division was in a different document, Bolt 12, which defined a connection between the DER -- the EV DER, between the charging equipment and the vehicle itself. But this Bolt 5, which is referenced for OCPP, and this is grayed out because it's still an unofficial standard, is an example of how a charging station could go back to a backend of an aggregator or a charging network. Frances can elaborate upon this in the afternoon.

Any other questions?

And, yes, there will be opportunities to engage with the Smart Inverter Working Group. And we welcome your feedback on how to best order this.

MR. BOURTON: My name is Mike Bourton. I'm the Founder of Kitu Systems. And we supply protocols to all parties in this room with respect to what camp they're in. So I don't normally make public comment because I'm a merchant. I sell to anybody, okay?

But I've seen a lot of misinformation being placed by all sides in this argument. I don't think they're telling a story that's wrong, they're just defining terms that are wrong. And I think the only -- you're not going to understand what they mean until you put a real expert

working group and invite the right parties to that group.

So I do support Amy's and CPUC's recommendation of a working group. Because within a working group, those things can come out and we can define the terms correctly, and then we understand what those things mean. So I'm supportive of the working group.

Thank you.

MS. NAGRANI: My name is Urvi Nagrani. I'm with Motive Power Systems.

There's just a big gaping hole in the plan, from Motive Power System's perspective, which is namely none of the approaches that are suitable for light-duty vehicles are suitable for medium- and heavy-duty vehicles. And given that we have a Sustainable Freight Action Plan, and given that we have a ZEV Incentive Program that is for these heavy-duty vehicles, we are beginning to put heavier and heavier-duty vehicles on the road. And for example, an electric refuse truck with 200 kilowatt hours onboard, if you put five of those you've got a megawatt putting onto the grid, and a problem that the utility just doesn't have a tool to help with.

Those early-stage customers come in as vehicle operators, as fleet operators, who have never had to deal with anything related to your work. So decades of

experience that you have put in, all of the roads you have built in the light-duty sector, that is very relevant on the light-duty side. But for the early-stage customer who knows operations and operations only, what they see is I don't know the rate, I don't know the impact to the grid, I don't know how much it's going to cost me to put the infrastructure in.

Every charger is going to cost me more and more because of the increased needs of substations. There is no one person who can give me an answer. Every utility has a different problem. And at the same time, the benefits for this VGI are distributed amongst the entire community, but the cost for this VGI is borne by me, the customer, who has a vehicle in that I'm using more and more cycles on my batteries, and I'm going to void my warranty faster.

Until we have a plan that has a way of engaging fleet stakeholders, compensating them for the degradation of batteries on their vehicles, and where the utilities who are already working on compliance plans can bring their expertise in a way that is accessible for a layperson, you're not going to actually get integration because a fleet is going to look at it and say there's a potential for a little bit of money and a hell of a lot of headache. Just the labor involved to participate is a barrier to entry.

So I would urge all of the agencies to think about

how we can think of usability as a barrier to entry. Because if we are trying to put more and more of these vehicles in disadvantaged communities, they do not have the depth of expertise on the legislative processes that you are proposing.

Independently from that, as a layperson who happens to drive an electric vehicle, I would caution you from requiring a network charger. Because, for example, if I'm going home from Oakland to SF and I need some extra charge, I pull over on Treasure Island. There are three chargers. There is one that works. The other two theoretically work. But if you put your little ChargePoint charger thing on there, the network always goes down, it crashes. The network to the charger is actually a barrier to entry in some locations.

So if you are going to require network chargers, you should also require network signal necessary to support them. Because the lack of data signal on those sites becomes great. You have a charger and you have the ability for one car to charge instead of three. But you already paid $4,000 per station for each of these vehicles.

So I would just urge you to think about the usability on the user side of both the fleet and the consumer as fundamentally different cases where it does need to be simplified.

Thank you for your time.

COMMISSION PETERMAN: (Off mike.) Nice set of comments.

MR. CRISOSTOMO: So that's about ten minutes of public comment.

Seeing no other hands, Adam, you'll be the last one before we transition.

MR. LANGTON: Hi. Adam Langton, BMW North America.

I just wanted to address, I think one of the assumptions I think I'm hearing here is that there is -- that if we do have a single standard and if we're using that single standard, that that's the primary barrier we're facing here. And I don't think it's the primary barrier to getting grid services from vehicles. I think that even if we were all using the same standard right now, we still have a question of what's the contractual pathway to actually getting those services into the market? And then what's the defined revenue from those services?

And so I think where we need to spend some effort is addressing those questions. And part of addressing those is thinking about what the use cases that we're actually going to perform are. And when we identify those use cases we'll be able to identify what communication is actually required to make this happen. So that would be the pathway

that I would suggest.

The issue of fragmentation was raised, fragmentation between the different networks and the different entities. That does exist, but it's not as if we are blocking each other from accessing the services. It's not as if the OEMs are blocking the charging stations or the charging stations are blocking the OEMs. That's not happening right now. If that was happening, then we'd say, okay, we need to step in and intervene. It's not happening because we don't have a pathway to access revenue from those services. So to me, that's the real big barrier that we should be addressing.

So what I think the state should be focusing is not on the how, which is what the communication standards are about, but on the what, what is that the state wants us, all these stakeholders, to do and tell us that, and then we can figure out the how on this and work with you guys to figure out the how.

I'm speaking later, so I'll stop now. But thank you.

MR. CRISOSTOMO: If there aren't any other questions, I'd like to thank our agency staff, and transition to our next panel and presenters with approaches to vehicle-grid integration with Sunil Chhaya from EPRI, Rich Scholer from Fiat/Chrysler, Adam from BMW North

America, and Dave McCreadie from Ford.

And so, Sunil, let me transition onto your slides. You can come up here or, yeah, or you can sit there. That's fine.

MR. CHHAYA: So very briefly, we're talking about standards and technologies, so let me give you a little bit of background on myself, so appeal to authority; right?

So I'll start with I started the day that I was told at General Motors that EV 1 was going to be a production program, so that was back in '95. So I spent about the first part of my career doing everything on the cars that's required to make the electric vehicles work on the powertrain side and hybrid vehicles. So my sympathies are always -- I can empathize with the car industry when they talk about challenges and opportunities.

And then for the last eight or nine years, I have been with EPRI, leading the grid integration efforts around standards-based. So we have got about one, two, three, four, five, so I've got about five OEM programs. We have got fleet vehicles, about 350 vehicles that is running around today are more or less -- that have standards-based activities -- standards-based technology on vehicles and off vehicles. So we've been working on improvement in these standards.

And lastly, I was disappointed to not find the SAE

activities that Rich is going to talk about referenced here. There has been, for the last seven or eight years, a concerted effort with the Society of Automotive Engineers to look at AC charging communications. That was not referenced. So Rich will get everybody up to speed very quickly.

Now let me go through the slides that I have.

So I was also -- the other thing is that I was heartened to see this additional fair (phonetic) working group, because that is exactly the gist of my remarks today, so let's get on with it.

Do I have the remote or I don't?

MR. CRISOSTOMO: I will control it from here.

MR. CHHAYA: Okay. Please. Go to the next.

MR. CRISOSTOMO: Time will start 45 minutes from 45.

MR. CHHAYA: Yes. Okay.

So there are -- you know, so one of the things I wanted to compliment PUC on is that this is definitely -- the ACR in September has definitely stimulated goal-oriented activities, so that's good. And a position is a good thing to have because that's the direction that -- so that's always a good thing, a proactive approach. And an approach that we mentioned, it proposes everybody to comply with the requirements. It also talks about the holistic principles

that Noel mentioned earlier, 11 principles. And it also invites the IOUs to propose alternative ways to comply with the same.

What we are proposing here is a VGI working group, essentially patterned around Rule 21's Smart Inverter Working Group. And it essentially talks about -- it takes on the tasks that Adam was just mentioning which is, first of all, translate the principles into the implementable technical requirements to start -- you know, take the holistic principles which you cannot give to a software engineer and say, here, design a system for me. You know, you're going to say, all right.

And against that, we can then talk about qualified standards and other solutions that drag the communications all the way from the utility down to the vehicles.

You know, I think that 15118 is great, in fact, in that it specifies communication link between the EVSC and the EV. But you did it without looking to see, how does it impact me, you know, and it's sort of out there. So we want to look at that.

And then our hope is that the processing forms, as Commissioner Peterman was mentioning, are related with VGI policy and regulatory rulings, EPRI.

And so finally, at EPRI, we will support any outcomes that come in terms of technology and

implementation. We cannot advocate for any of this as a 501(c)(3). But we'll make sure that they get appropriate diligence and technical foundation so they can implement it. So that is the one side, some of the (indiscernible). But let's just go through the rest of them.

So I'm not, of course, going to read of any of these, but Noel mentioned these anyway. So I wanted to first start with what we already know, which are the holistic principles of Appendix B of the ACR that came out. And they've got some really juicy things that we can bite onto.

Let's go to the next slide.

So we felt that in order for this to be a complete set of holistic principles, we needed to add a few others.

One is that if you utilities were going to be managing these as resources, then there is already a precedent set with Smart Inverter Working Group and smart inverters and to go all the way through four stages of VGI implementation, all the way to vehicle to grid, we need to at least be consistent and have some consistency, so that's number one.

Number two is that we feel very strongly about cyber security. We wanted to make sure that that was implemented and comprehended in the discussion.

Next thing was something that somebody just

mentioned here from another company, which is consistency across medium- and heavy-duty. A lot of the SB 350 filings are happening right now around medium- and heavy-duty non-road applications and so forth. We need to at least look at them to see how we cannot close the door on these things. Because I think really utilities need to implement ratepayer from their infrastructure, and we cannot ignore that.

Privacy of control conflicts, so this is something around who is in charge. If it's a facility and the customer is participating in the programs for individuals versus facility, who gets to hail the benefits, you know, so we are not giving incentives multiple times? And that will depend on incentives.

Extensibility, so future, and I think this was mentioned earlier by Steve, as well, so coexistence and interoperability, that's important because there are going to be a mix of technologies. Whether we want them or not they are going to exist for the foreseeable future. And we need to make sure that we don't get in each other's ways to ultimately dealing with the mobility application for the customer and the grid applications to the grid. So we need to make sure that we comprehend those, even if ultimately the end goal is to move and nudge the industry towards a standardized approach to do things.

And, of course, there are some other

(indiscernible), things like third-party innovation, customer choice, and competitive marketplace, we need to make sure that those are built into this. And also, reduce the up-front end use cost for site hosting. And customers, you know, cost is very important. So those are kind of the things.

And to start off the conceptual discussion, I also wanted to talk about a cell phone analogy. You know, so in my mind, you know, when I looked at it and from the weaker standpoint, and I thought to specify 15118 would be to say that every cell phone in the world would carry a Wi-Fi radio and that's it, and we'll only have three applications. It will text, email, and a browser, that's it. That was Steve Job's original concept to have iPhone to have only limited things.

Now, today's smartphones will have a number of applications sitting there that could be talking to your bank, your own personal banking account, they could be talking to land reservation (phonetic) systems. They all talk to the internet. They access whichever medium that's available to it, but ultimately deliver services that a customer will want to pay for. You know, applications cost money, the transitions may cost money, but that is all figured out by the downstream players.

So there is already a handy example as to how a

thriving VGI ecosystem can grow to multiple solutions that can coexist without clearly getting in each other's way. So that's absolutely a viable scenario.

Any more? The next one.

So when you start looking at end-to-end solutions and implementations, you know, and we, of course, we don't like to see a lot of standards, but they already exist, unfortunately. You can't get away from them. For example, from the utility side, you know, utilities would prefer to have a common interface that is defined -- or, you know, that is maintained across all resources, not just -- so we don't create a silo-type implementation where one set of DERs have to be addressed a certain way and others have to be a certain other way. That just gives unnecessary complexity and costs in the system.

So we feel that if there is one way to implement, then utilities can address whichever is the nearest endpoint, you know, similar to what we are doing for Rule 21, and Frances can go over that later. We can talk about a number of third-party operators, or we can go to EVSPs, or we can go to EVSEs, or we can go all the way to EVs directly. And this time those can interoperate and cooperate when necessary or operate solely by themselves, if that's sufficient. And we are not moving the rule important to critical role of services is this telematics, because

they may have a role, for example, around the data.

I think somebody was talking about telemetry. Well, telematics is meant for telemetry, and that is where you have data, a set of data that can be derived from the (indiscernible) that can inform the distribution system planners, the ISOs and so forth.

So we need to look at the system as a whole versus looking at segment of the system so that we derive the maximum benefits for the benefit of the grid, for the customers and the OEMs. It makes sense to.

So let's go to the next step.

So the other -- I wanted to also present, so we've talked about VGI Working Group. We sort of put together the relative readiness of each of the standards today against the VGI use cases in (indiscernible) use cases. And we find that they have varying degrees of readiness today.

But, you know, if you have to start today, you know, this is what the Smart Inverter Working Group did, they also looked at a similar approach. And they said, well, let's start with the standard that most meets the requirements today so we can build on it. So California Smart Inverter profile was built on a particular standard, was this relying on a standard that would take another few years to get up to speed. So this is just a reference point for you to look at. But there are some that are more ready

than others.

And I also wanted to make sure that the last column represented the work that we have been doing, that Rich has been leading within the Society of Automotive Engineers, and he'll get into much more details there.

Let's go to the next slide. I think that's it.

So essentially, the working group that we are proposing is pertinent. We believe that Rule 21, the Smart Inverter Working Group, was a successful pattern to follow because it essentially defined the requirements, technical requirements, defined and developed an implementation guide, so it has some referenced principals that provides us technical -- technology providers can follow.

We also believe that a certification body so that, you know, you can remove the confusion and test out interoperability as a part of the system itself. And then also develop a functional representation of a system, and implement a system that we can demonstrate and say here is one way to do it. And focus on end-to-end solutions and standards with uniform utility interface consistent with the other system in small-medium business, C&I, non-road, et cetera, that I was mentioning. And then we also recognize and understand and value the need for speed. So we want this to be done in an expedited manner so that experts can inform the rule making in 2017, et cetera.

And then basically what we would like to do is, please, happy to take on the role of leading this activity, if that is considered appropriate. We will support it in any fashion that is appropriate. We have an Infrastructure Working Council group that is an open forum. And it will have to be a transparent, consensus-oriented and open process with access and ability to contribute from all stakeholders, but at the same time it is action and goal oriented. It is not just a bunch of talk.

So that's basically the end of it. Thank you.

MR. SCHOLER: Okay. All right. I'm Rich Scholer. I'm the Manager for Vehicle-to-Grid at Fiat/Chrysler. I also Chair the SAE International Communication and Interoperability Task Force. I've been working with plug-in vehicles for over 25 years. I've worked on the standards back when we did the additional J1772. We only had DC charging for communication. Then I worked on fuel cells for a while. And I did do a plug-in fuel cell, so, yeah. And back into this for a while.

So please, next slide.

And this is an index. We'll cover a few discussions points. And I'm not going to read a lot of this, but I'll do the SAE Standards summary, some of the common material, and then go over some of the architecture between 15118 and Europe, how we would use that in the U.S.,

and how we'd use our SAE in the U.S. And then there's a lot of more detailed material in the background that we don't have time to discuss, but it will be available, and we can go into more detail at any point, so next time.

All right, well, and what we did was on the SAE Communication Task Force, we kicked off our effort ten years ago. And a year later we started working with the ISO team. So we had common approaches to our use cases and messages and protocol. Even though we worked independently we came up with the same approach, which was good because we understood the structure of what our standards needed to contain and separate.

The only thing I wanted to mention on item one there is Europe and the U.S. where DC charging is per a DIN SPEC. The reason we did a DIN SPEC is because it takes seven or eight years to get the ISO documents through the ballot cycle. We needed something sooner, so we did the DIN SPEC, and we updated the SAE according to that.

Now, there are variations between DIN SPEC and 15118, Edition I, 237, but I won't get into those. We are working on Edition II. There are 840-some comments that we're addressing that will be published the end of 2018. So we will catch up and we'll implement all the 15118 in our SAE Standards. It's a matter of when we're ready to have them mature enough to include. The --

MR. ECKERLE: Can I just ask quickly what a DIN SPEC is?

MR. SCHOLER: A DIN SPEC is a German document, it is a German standard, and it's DIN 70121. We did the first one -- I think I have it up there but I can't read it very well. We had an initial version. And then three OEMs and a couple of EVSE manufacturers did an update to that, and that was published in 2015. That's what all the DC charging is produced to and validated to for Europe and the U.S.

Now, a lot of those things are in the ISO 15118 Standard, but there are still some variations. Some of the messaged names themselves are a little different, so we'll address that as we continue to update our SAE.

When we do our communication we have what's called a schema, and we call out a name space, a major-minor version. So we -- it's just like a computer using DOS. We always use DOS. We can still use DOS commands. But we have windows. So match up, when we connect, we match up name space, major-minor version, and that's what we implement. So as we do more improvements and advancements, it's always rearward compatible down to the lowest level. We make sure that we always include what product is out there.

Now, from an SAE objective, we do intend to do 100 percent of our customers. There are no gaps in our SAE Standards. We have 100 percent of the requirements. We

have been working with EPRI and the utilities for over ten years. And we understand, it took me a long time to understand the use cases and the actors and so forth, but Sunil and others finally got that through my thick head and, you know, we got to the point where can generate our standards.

The other thing is, you know, the utilities programs are using SmartEnergy 1 (phonetic). A lot of the different organizations are using SmartEnergy 1. Those are all carried over into STAR 2 (phonetic), SEP 2. With the addition, we have a flow reservation message. We actually have a message from the vehicle to the utility that says how much power we want, how much energy we want, and when do we want it, during the charging connected period. And then we get authentication back from the utility and we dynamically control that. So we can optimize our charging in using SEP 2 based on all these different existing utility programs, and then more.

Now what I want to relate to our vehicle-to-grid, is assume you just now got your first cell phone and you've never used one before, and the instructions say, well, I've got to, okay, I've got to plug it in, I've got to put this cord in the bottom. And then I've got to have a wall outlet. And I've got to plug this in to power line-carrier communication. That's what we look at as the PLC

communication between the vehicle and EVSE.

What we want to do is we want to use our plug-in vehicles just like we use our cell phones. You know, when I take a trip a use Google Maps because I like point-by-point instructions. You know, I get a pop-up that says there's an accident three miles ahead. Do I want to save ten minutes by going an alternative route? I want to plan my charging session when I'm driving home. I might have a power outage at home. I may start at a DC fast charging and charge, and then use my vehicle as a home generator or a DER if I need grid stability when I get home, and then charge later. I want those opportunities.

And, you know, as we all use our cell phones now, we want the same features with our vehicles. We need to plan for our communication session, not wait until we're connected to an outlet and ready for the charging session.

So if you can go to the next page?

COMMISSION PETERMAN: Rich, let me just interrupt you quickly. I liked your analogy. But what I don't fully ascertain is what do you think is missing for that to happen, the equivalent side on the -- for electric vehicles?

MR. SCHOLER: Well, SEP 2 --

COMMISSION PETERMAN: Okay.

MR. SCHOLER: -- is something we could use, power line carrier or Wi-Fi or ZigBee communication. And we could

use our vehicle telematics to get that information to the car while we're driving home or while we're at any location.

COMMISSION PETERMAN: Okay. Thank you.

MR. SCHOLER: PLC is only -- it's a carrier signal on the power circuits between the vehicle and the EVSE. You have to be connected to do the communication. You wait. You have to wait until you're reading to charge, but it may be too late. You don't have power, you don't have other things, you know, we don't want to wait that long.

And we want to make this transparent to the customer. When I get the popup that says there's an accident ahead, I may only get that, you know, when it happens. You know, otherwise it never happens, I go all the way to my route.

Now what we've done in SAE is the left column are the use cases, the center column are the messages and signals, and on the right are the different protocols. And like I say, we structure just the same as 15118. Now we're also separated this into six different dash sheets (phonetic) because we wanted to keep the teams focused, and we wanted to be very dynamic on how we published our documents. We can publish a document fairly quickly. We can open up a document, update in a month or two if we need to, depending on the magnitude of changes, put it through the biocycle (phonetic), within two or three months it's

published. So we're very quick on how we can do our updates.

And we started with smart charging. Now, as you move from the top to the bottom, or bottom up, all we do in these sessions, like wireless charging on the bottom is only the unique items for wireless charging. It still reuses a lot of the DC charging messages that are in our DASH 2 (phonetic). So we have our customer-to-vehicle in DASH 5. We have diagnostics in DASH 4, and so forth. So we wanted to keep these separated. We have full use cases, full messages and protocol.

Now, as you can see on the right, there's several arrows. So, you know, once we do smart charging we could use power line carrier, we could use telematics, we could use anything we want.

The other thing is, you know, from a DC charging standpoint, we are using the CCS. It's a Type 1 connector in the U.S. and it's a Type 2 in Europe. The only difference is Europe has two more terminals to be able to do three-phase, so it the CCS system.

And we have interoperability documents, three documents there on the bottom for that. And then a security one that Frances is helping us on.

So the next page.

And what I wanted to do is identify some of the

common material. And this is what I identified. From a DC charging standpoint, we are using the DIN Standard. The DIN Standard, Edition 1 and Edition 2, all will do DC charging. Now, we will update our SAE to Edition 2 of the 15118. That's still a couple of years out until that's published. But we will not do it at the CD stage. There's an FDIS stage that's still six months or so before publication. We'll bring our SAE documents up to the same level at that point because only editorial changes can be made, not technical changes. So --

MR. CRISOSTOMO: And, Rich, just to clarify those acronyms, you're referring to the processes in the ISO standardization process --

MR. SCHOLER: Yes, ISO.

MR. CRISOSTOMO: -- the Committee draft, and the final draft International Standard?

MR. SCHOLER: Yes.

MR. CRISOSTOMO: Is that what you meant?

MR. SCHOLER: ISO and IEC have four basic steps. They have a new work item proposal. They have a working draft. And then a CD stage. The CD stage is when it becomes more public for open documents, more comments. And then the F DIS is right before publication, where you only have technical -- or editorial, not technical --

MR. CRISOSTOMO: Thank you.

MR. SCHOLER: -- comments.

The reverse power flow, there is a message for AC DER in the Edition 2 of ISO. There's two messages for DC DER. So we'll make sure that we're aligned with that.

As far as the customer-to-vehicle, that's payment. That's in our DASH 5 documents. And up to this point we haven't been concerned about payment in the U.S. because all the EVSEs are pretty much free, except, you know, we will pay for the spot. We will include PNC, EIM -- PNC is plug-and-charge, which is the power line carrier between the vehicle and the EVSE. EIM is external identification means, which is an RFID tag where you have to have an additional step. But we'll also have your cell phone. You'll tap your cell phone at EVSE or the charging station when you go to a public place and be able to pay for your cell phone. So we're not restricting things to certain protocols. We're not restricting things to power line carrier. We want to make sure the customer can use their vehicle just like a cell phone.

And then from a wireless charging, there's been a lot of effort on the wireless charging because it does include wireless communication. But that's the initial service discovery, final service discovery as two or three vehicles are approaching two or three pads, that gets us to a communication standpoint that we can understand which pad

we're going to land on before we get to the five meter where magnetic vectoring takes over. So, you know, we do have wireless communication in wireless charging, of course, but it still carries through the same energy transfer as DC charging.

So if you go to the next page?

And this is some of the architecture. I just wanted to briefly show this. Sunil has already shown some of this. This is a little different cartoon. The architecture in Europe is the utility talks to the EVSE. The vehicle talks to the EVSE. And the EVSE is permanently installed, hardwired to the site.

If you go to the next page?

It's a little different in the U.S. because if you have a private EVSE and it's less than 50 amps, I can put a 50-amp plug or a 30-amp plug on that thing. I can unplug it from the wall, take it off of the fixed-in-place bracket and take it somewhere else.

Now, we've agreed with the utility companies, with 3,200 utilities, 10 to 11 years ago, to use SEP 2 from the meter into the home. Now the energy service interface is a trust source for the utility. And it's the same model, whether it's in the home or a fleet or a business or any other application. You know, we will get a SEP 2 signal from the meter to the ESI. The utilizing could still have

their own specific communication, BACnet or whatever they want to have, you know, on the backend. But it's SEP 2 to the ESI.

And then what we would have for 15118 is we would have PLC communication from the vehicle to the EVSE. And then we'd have a third-party communication. Now, I've shown a slide in the background that shows a difference between a gateway and a bridge. This requires a gateway communication at the EVSE where the EVSE has to read the signal at the top level of the SAC (phonetic), the application layer, transfer it to the other protocol, and then send it back out. It has to read it, transmit it back out on the application layer, the side. A bridge simply transfers the signal at the MAC (phonetic), the second layer of the stack, and it doesn't read the message. All it does is change the protocol from one to the other.

So and if you can go back to the -- yes. One more. Okay.

So that's what the EVSE has to do in its application with 15118 in the U.S.

And the last slide is -- next one. Yeah.

This is what we've done in our SAE and our IEEE architecture. What we do is we do SEP 2 from the vehicle, all the way to where the utility has its own unique communication. So that's -- and we still cover the three

basic prices.

What we have now is we're finding that utilities, like in Illinois, they're actually using real-time pricing that changes every five minutes. And if I can plan to use negative pricing from 2:00 to 4:00 in the morning while I'm driving home from work, that's great because that's when my car will actually do the charging process. I don't have to wait until I'm connected, if I want to capitalize on clean energy. Like Texas has too much wind at night. They actually pay to get rid of the wind energy. So I can plan those sessions as I'm driving home, using telematics or other approaches to the vehicle communication. I don't want to be in a reactive mode. I want to be in a planning mode.

Now we've all talked about extreme fast charging, too. Right now a vehicle, if you drive 30 miles a day, you're basically ten kilowatt hours. That's seven kilowatts of charge for two hours. When we go to extreme fast charging vehicles and we only charge our vehicle once a week because we're going to treat them like an ICE engine, that 2 hours changes to 10 to 12 hours. We absolutely need to have planning and we need to have communication for the charging session.

And the reason the utilities use demand response now is because every home, with few exceptions, have an air conditioner. They have a hot water heater that draws a

kilowatt. That's seven kilowatts for two hours per vehicle. Once every home has an EVSE, we have to use these other tools to be able to do the communication.

Thanks.

MR. LANGTON: All right. My name is Adam Langton. I'm with BMW. And I'm going to give you guys a little background on a smart charging program called Charge Forward that BMW is conducting right now with PG&E. And this is a standards-based approach, but it doesn't involve any communication with the charging station. And so I want to describe a little bit about how this works and then talk about why this is relevant to this particular conversation.

So BMW has a contract with PG&E to provide demand response. And to do that we engage our drivers in the charge forward program. And as part of that program they agreed to let us curtail their charging, and we compensate them for doing that. We've been doing this program since the summer of 2015, and so it's about 18 months. We've done about 170 demand response events in that time, and we've had a pretty high success rate. This is the first pilot that we've done on this here in the U.S. We had a 94 percent success rate in meeting those 170 events which we consider very successful, considering this is the first time that we did this.

If you'll go to the next slide?

I want to explain a little bit. What's interesting here is I want to explain the technical approach and why this is -- and then talk about why this is relevant to the conversation today.

So the approach here that we use is we receive an OpenADR signal from the utility. So this is a standards-based approach. We get an OpenADR signal for when the event is and what reductions the utility would like to see from us. That goes from the utilities cloud to our cloud, the BMW cloud. And then from there the BMW cloud looks at the participating vehicles and determines who can participate based on who's plugged in, what your state of charge is. We also give the driver an opportunity to override and say that they do not want to participate.

Our overall approach here is that drivers probably don't want to be hassled about this. They don't want to make a lot of decisions throughout the day about whether they're going to charge or not, whether they're going to smart charge or not, so we try to take that out of their hands. So it's a program where they have to opt out. They're automatically opted in, and they can choose to opt out. We give them a smart phone app that allows them to opt out either on a daily basis, or when they receive notice that they're in an event, they can opt out of that event, as well.

So we look at the vehicles, determine who's going to participate, and then we use the Telematic system to communicate directly to the vehicle and curtail the charging. So we're able to do that. Originally we were doing day-ahead signals, but we quickly converted to five-minute signals, so we're able to perform in under five minutes in response to a signal. So when the utility gives us that signal, within less of five minutes we can curtail the charging.

We've been doing that for the past 18 months. We'll enter a new phase in this starting in 2017. So we're actually doing enrollment for that right now where we'll expand the number of vehicles and we'll expand the use cases. So what we did in the first phase of this was we just did curtailment of charging. We would stop the charging in response to signals from the utility.

In the next phase, we're going to do much more advanced use cases. We want to be able to start the charging when there's over-generation events. And we also want to be able to explore the ability to manage charging over multiple events, potentially over multiple days.

So we think that the battery size for vehicles is going to continue to expand, and so vehicles will have more and more range. And when they have more and more range it becomes less necessary to charge every night. Charging may

become less predictable then. So what we'd like to do is take advantage of that range by determining the best times to charge, which may not be within a four-hour window for a given charging event but may happen over multiple charging events where we stop the vehicle from charging one particular charging event and start it during another that happens hours later, or perhaps even days later.

With this, one particular use case of this, we'd be able to respond to solar over-generation during the day. We think that to be able to do that, what's really necessary is to stop a vehicle from charging during the night, and then it get it to charge during the day. So this is complicated. It involves a close relationship with the customer, and it involves over multiple charging events. And so we think that where we're positioned as the OEM, and our communication system works really well for this.

So next slide, Noel.

So this is just an example of a screen shot of the app that we have. The priority here is that the driver is always able to complete all their trips. So we want to give them ability to override whenever they need to. And we do think that the telematics approach, coupled with standards, can meet advanced use cases. We know where the vehicle is, so we can use that to determine what circuit the vehicle is on, and then work with the utility to provide services that

are specific to a specific circuit.

Because the vehicle is moving around to different circuits, we actually think that's an advantage in the long run. Because if we're able to manage over multiple charging events, we can actually help work with the utility to get the charging not only to the time that the utility wants, but also to the circuit that it wants. So we think there's a lot of sophisticated use cases that can be done here.

As I said before, we can -- this program that we're doing now did not require any hardware modifications to the vehicle. It also does not involve any communication with the charging station. I think this is really important to understand here. I can potentially do this with any of the iPerformance vehicles that BMW has on the road. We don't need to make any modifications to those vehicles to enroll them in a program. And as I said before, what I think the barrier here really is, is it's not a standards issue, it's a matter of having a contractual pathway and a defined revenue to be able to do this.

And so that gets at the what that I mentioned before rather than the how, because there's many, many different hows that we can use here. What we would like to see is more of a focus on the what. And a specific example of what I think the state can do in this would be to actually mandate the utilities to procure VGI services. And

they can do that now, to actual mandate in the megawatt-scale to actually buy those services. And think when that happens what you'd see is that these different stakeholders would then come together to figure out the how then to meet the what.

So BMW does support, that being said, BMW does support the idea of doing a working group to explore these standards. But I think one aspect of that working group is there should not be an assumption that the communication must go through the charging station. That should not be an assumption of the working group. That's going to lead us potentially in the wrong direction. I think we need to be thinking about it a little more broadly.

Thank you.

MR. CRISOSTOMO: And, Dave, in the interest of time, so that we can get people out, I'm sure there's a desire for stretching legs, if you could keep it to five minutes, and so that we could get a few questions in? Thank you.

MR. MCCREADIE: So hello everyone. I'm Dave McCreadie from Ford, from the Connected Car and EV Services Group.

And, Noel, I think I can do better than five minutes, so --

MR. CRISOSTOMO: Thank you.

MR. MCCREADIE: This is just to wrap up this bit of four speakers here. And I appreciate the opportunity to talk to the Commission on this important issue.

So I think the perspective that I wanted to provide is that, you know, we've seen -- I guess the business value here, as it's been mentioned a few times now already this morning, has not been especially evident thus far. Over the last five years there have been a lot of pilots that have been run by a wide swath of OEMs. Those pilots have, in our view, not especially stuck very well. I mean, they've been very time bound, very limited. And I think what we're all trying to get towards here, toward the 1.5 million vehicles, is a very highly scaled version of VGI. And I think all the OEMs are fully behind that and supportive.

So in our view, the reason that everyone has been going slow is because from both sides, both on the utility side, as well as on the OEM side, certainly, we've been trying to feel our way through this value question. And just to reiterate, I think, what Adam has said a few times now, that appears to be the main barrier because the limited nature of the pilots over the last number of years has not necessarily, in our view, been due to a lack of communication technology, it's more been the question of how is the value from these vehicles really going to be

unlocked? And so we would be very supportive in what Adam was just mentioning about trying to move forward on that front.

So we would like to see a program that would be much more broad in nature, several years, where it would be coordinated across all the IOU territories, full state of California, where very meaningful benefits would be apparent to the customer, where we could opt in a lot of people, and just to get mass enrollments behind all of this.

So, you know, if there was, as Adam was suggesting, a mandate to get all the IOUs to procure grid services from plug-in vehicles, and with a competitive RFP bidding process where the OEMs and some of these other stakeholders would be able to bid in these aggregated loads that we know they can perform to again, like I said, help unlock this value question from the cars. And in so doing I think it provides a way to demonstrate that this is, because there's many stakeholders involved here and there are true benefits for everyone.

So I guess if you could go to the next slide, Noel?

In the interest of time --

COMMISSION PETERMAN: May in interrupt with a quick question, because I have to pop out in about 30 seconds?

MR. MCCREADIE: Yeah. Sure.

COMMISSION PETERMAN: So on your last slide, when you talk about a two-year program at scale, do you have any estimate of what do you think scale is? Are you thinking this is a certain amount of cars, certain percentage of car sales, certain amount of megawatts?

MR. MCCREADIE: Yeah. So, no. I mean, in our view this would be for the first time where all the OEMs would be enrolling customers on the order of thousands. So, I mean, this would be thousands, tens of thousands of vehicles across the state, where the state would, for the first time perhaps, be able to realize on a widespread basis, you know, VGI as it's been envisioned. And we would all like to head down that pathway, as well.

Yeah, so anyway, on this slide, I'm not going to tick down through all of these things. But it's just the point of making that there's a lot of stakeholders here in this space, we see all that, and everyone needs to win; right? Because when any given stakeholder doesn't see the returns for what they're putting in, then there's going to be an issue. So if we were able to do a scaled program like this, we think that that is the clearest pathway to help really realizing again the VGI that the state is going after and allows all the stakeholders to realize the value and get this really entrenched in their businesses.

So I guess with all of those things said, you know, again, we would like to see better access to the value is really, I think, what the OEMs are after. And, yeah, thank you. And so, you know, we don't believe that the barrier here has really been a gap or it's been a technology barrier or a standards-based barrier. We believe that the barrier has been one of the value not especially being apparent.

And I guess just as a final thought, I'd like to just touch on a couple things. I mean, I appreciate the comment that Steve Davis made at the beginning in the acknowledgment that the OEMs are -- well, first of all, all of us, I think, most of us are in the process of deploying 15118. So, I mean, we're all moving in that direction anyway for those use cases where 15118 is the right pathway. But at the same time, we don't want technology solutions dictated to us. And as Adam has fully shown with what BMW/iChargeForward is doing, there are other ways that can realize a lot of grid value right now, today, and we just want that to be recognized.

So, you know, understanding that there is a need for market signals to be sent, I think that helped us through the previous period where we were grappling with multiple physical chargers. And I totally understand that having a market signal sent by way of infrastructure could

be a very important thing. Again, it's just we just want the recognition that that is not necessarily the only way to resolve the problem, and there's other pathways that can be used to quite good effect. We just like a way to show the state that with all these vehicles, that we could get to enroll with a way to utilize the value, we see that as a great pathway forward.

MR. CRISOSTOMO: So I'd like to take a question quickly, maybe, if you don't mind.

In terms of defining value and targets, what type of quantification of value is necessary? And what's a number of megawatts that would be enough for automaker action? I guess to any of the panelists.

MR. MCCREADIE: So I don't know that I'm -- I mean, what Ford would like to see as a way -- a mechanism for us to learn, you know, we would like to have a way to be able to opt in hundreds of kilowatts or megawatts to the grid. I mean, from -- when we look at it, I need to look at this through more of a customer lens.

I mean, through all the pilots that I have seen across this space in the last three of four years, you know, it's the question of what is a meaningful return or incentive from a customer's perspective? You know, being able to use their car's batter to serve the grid with any potential risk that they see in doing so, what the

meaningful dollar figure that they need to have to want to participate in this? I'm not certain that we really know the answer to that yet, but it's probably in the, you know, hundreds of dollars per year. So, I mean, that would be one thing that we would be very eager to be, you know, trying to work on and figure out with what we think we need in order to incentivize the customer to really participate in something like that.

So, Noel, I don't know if I fully answered your question, or if any of the others have any comments on that, but --

MR. LANGTON: I think that it's a good question, and I don't think we know the answer yet, and it's something worth exploring.

In terms of the scale, from the BMW perspective, I mean, for our customer, we would want to do this at -- certainly at the thousands of BMW iPerformance vehicles. I think we could handle that. I think we'd learn a lot. How that -- you know, it's hard to think about that across different OEMs. I can't offer, you know, any perspective on that.

And then the value question, I agree with Dave, it's an open question that we -- I think rather than -- you know, there's two sides to this. One is figuring out what the driver needs to participate. And the other side is what

is the value that we're creating on the grid, and I think that can't be lost. But it's possible we go out and we start this without knowing what the value on the grid is, and we figure that out through this project. So we don't wait to know the answer to that and we don't debate that. We say, okay, we're going to go ahead and we're going to start doing it, which the Commission has done in other areas, particularly in storage where we say -- and that's why competitive solicitation can work for this. And it can be structured so that you get broad participation and you get people doing different things, and then we use that to learn. If it's over multiple years we can then say, okay, after that period, you know, did we -- how did we go forward after that?

MR. CRISOSTOMO: Any questions? Maybe we could close in one or two, so one and two, Urvi, and then let's -- there's plenty of time, so we will be able to continue this after lunch.

MR. SOLE: Very quickly, my name is Barry from Porsche, and I have two questions.

Rich, the first one is for you. You spoke about this flow reservation. Why do you think that is not possible with 15118, but over another channel like Telematics, to reserve in advance a charging schedule before I'm at the charging station?

MR. SCHOLER: It's not in the messages right now. You asked for energy voltage and current, and you do that in the charge session, not ahead of time. We do this when we first plug in. And we could do it while we're driving from home, you know, through telematics. We could do our flow reservation, you know, while we're in the process of driving our vehicle.

It's not a matter of you can't do it in 15118. It's a matter of when? Do you want to plan ahead for your charging session? Do you want to wait until you're connected and in the energy transfer session to be able to do it?

MR. SOLE: Okay. Good. Understood.

Adam, the next question was for you. So I like what you're doing with your iPerformance cloud-based management of charging schedules, but do you not take the risk of cutting out the middleman or the charge point operator? If you take the use case, charging at work, between you guys and the utilities, you've now made a decision to increase the charging power of the vehicles. The charge point operator, the company, where you charge at work may incur demand charges, or you're making a decision without considering his needs. And at the end of the day, he's basically footing the bill. How do you overcome these issues?

MR. LANGTON: That's a good point. I wouldn't say that we're necessarily making that decision without working together with the facility. So there is an opportunity there within this use case to work together with the facility to understand what their demand charges are and deal with that.

There will be cases where you do not have a network charging station, in which case, then not only do we not have an issue with them, but we're actually enabling smart charging where it couldn't occur. If there is a network charging station, then there can be a relationship worked out there to deal with that, as well.

MR. SOLE: Okay. So --

MR. LANGTON: So I guess I don't know the answer to that, but we don't figure it out until we give it a shot.

MR. SOLE: Okay. Thanks.

MR. CRISOSTOMO: So Dean had his hand up. And then, Urvi. We have a question from the phone but, Craig, do you -- is it --

UNIDENTIFIED MALE: (Off mike.) (Indiscernible.)

MR. CRISOSTOMO: Okay.

UNIDENTIFIED MALE: (Off mike.) I'll wait and see if anybody else addresses any other questions.

MR. CRISOSTOMO: Okay. But I don't want to keep everyone, because we do have a lot of time to have this

conversation in the afternoon. And I would imagine people are needing a break, just in case, so let's keep it tight.

MR. TAYLOR: Let's keep it tight. Dean Taylor, Southern California Edison.

Noel, do you mind bringing up Sunil's presentation, especially to the end-to-end slide?

Edison, I think, is fine with the suggestions by Energy Division and EPRI of a working group and agree with the two automakers on that. Obviously, there's a lot going on. This is a very complex space. What I liked about Sunil's slide is it took the 11 principles and added to them. And I think there's even another one that wasn't on there, which is the speed to market, how can we get this out there quickly.

I'd also really emphasize the cost. Several other speakers were emphasizing the need to look at the costs.

And if you could go to the slide on end-to-end solutions? That one.

What's particularly, I think, useful there, this is, I think, meant to be just an example of some, but the point is that there's a lot of different ways to get from the car all the way to the grid. It could be a combination of two standards working together. It could go through directly. There's a bunch of different platforms. I mean, there's OVGIP, there's DHC, there's others. So I think from

a standards viewpoint or a platform viewpoint, this is just a way to look at a whole bunch of different solutions, not just the ones, you know, presented there. And then rank them according to, you know, a set of 20 or so criteria. Obviously, there's more to do. But just from a utility point of view, I think we're on the hook to come up with what are the different options and why. And so we need some kind of set of criteria principles to look at a wide range of end-to-end solutions. So that's -- I think this would be very, very useful.

And then, in addition, to be able to get things on the record and to help the Commission and other agencies moving forward.

MR. CHHAYA: The group, though, the working group would be to enable any party that wants to take on the role of being the utility to EV interface, to enable them to operate in that space.

MR. CRISOSTOMO: Urvi, go ahead.

MS. NAGRANI: Okay. So two things, once again, pointing out the elephant in the room of the fleets, specifically as it relates to the analogy you used about cell phones. I think the analogy is apt if you think about communication's interfaces and what the FCC's role is versus what is the fiscal role of setting up those systems.

So, for example, if the utility wants to have a

role in a networked system, there has to be some buy-in, in the same way that when I got this phone, I didn't have to pay for it. AT&T paid for it to Apple. Apple got paid as a technology provider. And I, as a user, have that built into my cost of operations. If you don't have a built-in modeling of the costs right up front, the user is not going to suddenly go, I want to think about my operations costs, as well as my vehicle costs when there's overlapping areas where they've never had to ask that question before.

If you do build a working group that is focused predominantly on the light-duty side, I would urge you to write "light-duty" in the name of the working group, so that way it does not stand as a standard for all types of vehicles. Because in the same way as this phone number equals me as an individual, I also have a different phone number for my office. I have a different phone number that gets directed through Google Voice. And they can all go through the same device, I can have multiple standards. And I can also have a phone number that goes somewhere that is completely non-networked. And as a company, I can have a phone number coming into one place, and then be diverted into 100 different others.

All of those are options that are enabled by our Communication Standards if we look at the FCC as a model. If we are going to go into that way with communication

standards on a vehicle, we need to allow for the full scale of commercial operations of users. Because when I am using a car share vehicle, it is different than with my personal vehicle, which is different than when I use a fleet vehicle with a different owner.

And the second part is I like BMW's approach with the proprietary cloud, a use case where it is very user centric. I would urge all of the utilities to form a standardized API, so you're not relying on individual technology providers to have in-house software expertise and utility expertise in order to engage with the standards so that all users, whether they buy a Fiat or a BMW, can have the same access to demand response.

MR. LANGTON: Just one comment on that. The communication that our backend is doing with the utility backend is using OpenADR, which is a pretty common standard. So there is a standard there already.

And I don't know if that addresses your last question.

MS. NAGRANI: I mean, if I were to think about OpenADR, I would also think about UtilityAPI. I would also think about all of these other technology providers who claim they have the solution of the open system. Unless the open system is coming from the regulator itself, and we know that every time there's a rule-making change or that there's

a state-level change, users are going to be protected and you're not going to have to rewrite your standard, that doesn't solve the problem of a technology provider integrating.

MR. CRISOSTOMO: Could we open the line to Stacy Reineccius from Power Tree?

MR. REINECCIUS: Can you hear me all right?

MR. CRISOSTOMO: Yes

MR. REINECCIUS: Okay. I just wanted to point out that there's kind of been implicit assumption in many of these direct-to-vehicle programs, which is that somehow the EV charging infrastructure, the electrical wire interconnect, and the value of the actual parking space and maintenance of that are somehow a given, and that those costs and the cost of operating an infrastructure get directly impacted by the rate of charge and the number of vehicles that are utilizing that charger.

And so if care needs to be taken in any kind of VGI compensation program to assure that that host site costs, and the associated electricity costs, and the associated demand charges, and the associated property costs, and the time value of that are taken into account. Because if they're not, then the demand response reduction in the rate of charge to the vehicle shifts the cost onto the property host. And if the property host isn't seen that

they're being compensated as part of that, they're going to find another way to do it. They're going to raise the cost of parking. They're not going to install EVSE, and/or they're going to impose some additional other added cost.

So the direct-to-vehicle model is a piggyback on the property host, but you can't forget the property hosts.

MR. CRISOSTOMO: Thanks, Stacy.

MR. MCCREADIE: Yeah, I'm sorry, yeah, this is Dave McCreadie from Ford.

I think that goes back to the comment I made in closing about there are a lot of stakeholders in this space, and everyone has to have a piece to be able to win. And I agree with your comments. And I think the value question is, you know, just as much front and center for the OEMs as it is for property hosts and EVSE network providers and utilities and everything. So I think that's, in my view, that's in the spirit of wanting to move forward with a very large-scale program where we can figure this out more appropriately.

MR. LANGTON: And this is Adam.

I would agree with that, as well. I think one of the questions, like Stacy is raising a good issue. One of the questions, though, is if there are other ways to deal with that, that if the site host can deal with that directly through the driver in other ways, then we want to consider

that, as well. Because if they have ways to deal with it, it's not necessarily a barrier then.

MR. CRISOSTOMO: I'm hoping that Craig's question can be addressed during the afternoon.

And so let's meet back here at 1:45. I apologize for the missed timing, but we will continue our discussion and shift time from other Q&A to the next sessions. Be back in an hour please.

(Off the record at 12:44 p.m.)

(On the record at 1:44 p.m.)

MR. CRISOSTOMO: So just if you could take out your agendas out and mark new end times, so that we are able to understand where we are, given the fire drill and -- Mike Bourton, I'm looking at you. Please stop talking. Hi.

If we could all take out agendas so that we can update the schedule. I want to make sure that people who do have afternoon flights are able to get home on time. I have a proposal to get us out by 4:15 and still get all the content, the prepared content in.

So given that we had a little overtime for the first panel session, please mark the end for the next hour -- or for the next panel at 2:45, so that we have an hour. The one after that would end at 3:15, after that, 3:45. And then we're going to do some combining and end the afternoon at 4:15. That requires elimination of some public comment.

But I built some extra time. And I think some of the last parts would be shorter than I was expecting.

But the big request would be to ensure that anything that we don't talk about in person today gets captured in your comments that will be due to the docket.

So again, to modify your schedules, if you just joined us, end time for the next panel is 2:45. End time for the one after time for comments, 3:15. Frances' will end at 3:45. And then we'll do some combination of the last parts to end at 4:15.

Does that sound good for everyone?

Please stake your seats, and so that we can get started. We need to kind of crack the whip.

So this next panel provides perspective from the ISO 15118 and implementation of the vehicle-to-grid communications interface.

And we will get started with Daimler. Is --

MR SOLE: Is she behind there?

MR. CRISOSTOMO: So to introduce this panel, we have Judy Brunson from Daimler, Barry Sole from Volkswagen Group, Stephen Davis from KnGRID, and Stephan Voit from KnGRID.

So, Judy, I will control your slides.

MS. BRUNSON: Okay. Thanks. Hi. Sorry. I apologize for running back in late after lunch. Forgive me.

So if you could go to the next slide please?

One of the questions that we have as an OEM is why do we believe that EV cells have not reached the level of sales that we've all anticipated so far?

At Daimler, we think that the reason largely has to do with the overall customer experience. And there are a couple of customers that we're concerned with. There is the personal use customer, the end-user, the EV driver, and there's also the fleet-use customer. And there are a couple of things that we, as OEMs, have control over to influence that experience. And there are several other reasons that we don't have direct influence over, but we have indirect influence. Those things can be considered.

For example, the price of fuel today is a lot lower than it was say seven or eight years ago. That's absolutely one of the reasons.

There's also the whole range anxiety issue that does still exist, something that we think that we do have direct control over.

There's the fueling, the EV fueling scenario, largely on the infrastructure side, where it takes a combination of efforts between the EV and the EVSE.

If you could go to the next slide please?

So when we talk about the customer experience, for us at Daimler there is a particular standard that has a

level of functionality or that offers a level of functionality that other communications protocols do not offer, and that standard is ISO/IEC 15118. It's been talked about today by several of the other presenters. But for us at Daimler and the OEM community, there are some very real reasons why we believe that that standard is the most viable protocol for implementation as a standard in the U.S.

The first being is that it is, outside of the U.S., it is a global standard. It is a standard that has already been vetted. We, as Daimler, have several global demonstration projects where we have interfaced with consumers and customers and understand how consumers want to interface with their EVs. And we found in those demonstration projects what the customer expects, what he desires, and the fact that 15118 offers those functionalities as a reason, one of the main reasons, why we as Daimler support the standard. Now, there are several risks associated with not implementing a standard like 15118 that we can talk about a little bit later. And there are several benefits for the OEMs and for all of the EV community stakeholders that 15118 also offers.

Next slide.

So there is an official statement on behalf of the German OEMS, and I wanted to point that out here. Basically, that statement says that the German OEMs, we

absolutely support the implementation and the use of 15118 for both AC and DC applications. So I think it's critical for us to make that statement here and to understand that because we've heard earlier today about the uses of 15118 on the AC side, the uses of 15118 on the DC side, but I think as a German OEM community, we agree that 15118 is the most viable communications protocol and it should be standardized in the U.S.

Next slide.

I won't read through this slide exactly. But the point that I wanted to make on this particular slide is that we agree that from a central server standpoint, I won't necessarily reference the OVGIP, but that, the OVGIP, is one example of a central server, that a central server can exist and coexist in the same marketplace with 15118, and other protocols, as well.

So next slide.

So what we see here is that most of the OEMs have made statements and said that all of us agree that in some form at some point we are all going to implement ISO/IEC 15118. That's going to happen. I don't think that there's any debate within the OEM community. And I think one of the reasons that we are going to do that is because it is a standard that has been tested and tried. It's a vetted standard, and it does all of the functionalities that we

don't necessarily see with some of the other protocols that exist out there.

We've heard earlier that some other standards, sub 2.0, for example, intend to morph themselves into an ISO/IEC 15118 standard, and that's great. We definitely don't have an issue with that. But I think the problem is we need to move now as an EV community. We've spent several years talking and discussion about how the infrastructure needs to be developed. There's been a lot of investment on the infrastructure side. And as far as the OEMs are concerned, we want to make sure that the communication link between the EV and the EVSE is a standardized communication.

Pay attention to the lower right-hand corner of the slide on the screen. We recognize that there are several protocols that can exist as a communication link between the EV and the EVSE. What we don't want to see as Daimler, and I don't think ultimately what any of us in the OEM community would like to see, are multiple communication links there because it poses many problems on the infrastructure side.

Our EVSE manufacturers/colleagues would then not have a defined specification to design for. There are issues, multiple issues that could be brought forward with MOTS (phonetic), when you have multiple connection points from a security standpoint. So several issues that we see

if multiple standards are allowed to exist in that connection point.

So what we as Daimler see is the most efficient way to establish a communication between the EV and the EVSE is through one standard, one standard that has already been vetted, and that standard we see as ISO/IEC 15118. It offers all of the functionalities that we need currently today. It's not a standard that has to be developed further, although the standard is continuing to evolve. There are other 15118.2, 3, 4, 5, things that are coming down the line. But where the standard is today, it's at a point where we as OEMs and where we as an EV community can implement it and move forward with an interoperable interface to the infrastructure side.

So when we ask the question about what needs to be standardized, there are several points. There's the user. There's the EV. There's the EVSE. There's the grid. What's not pictured here?

There's also the backend. We believe that the communication between the EV and the EVSE is critical, and that that connection point should be standardized as ISO/IEC 15118, but that does not eliminate the ability for the other stakeholders to use other protocols. The community link between the user and the vehicle can be any protocol that the OEM deems necessary. The communication link between the

user and the EVSE itself can also be a barcode or any other protocol between the EVSE and the grid, whatever standard. Whether it's OpenADR or Telematics or whatever is desired by the OEM is available to be used in that case.

So when we as Daimler say that we support the implementation of ISO/IEC 15118 between the EV and the EVSE, it does not eliminate the ability for other protocols or standards to coexist, as well.

This particular slide, which was animated, which is fine that it's not, but I guess the point to make here is that 15118 offers us a turnkey solution where we're dealing with plug-and-charge, EV authentication, grid load management.

These are three very specific use cases that are defined in 15118 and that really allow the EV and the EV end-user, the customer, to have the experience with the vehicle that he's absolutely looking for.

What we've determined, and several of the demonstrations that we've had in Europe, and even in our UC San Diego Project in Southern California, is that customers don't necessarily want to be involved up front in making decisions about how the vehicle charges or when it charges. They want these things to happen in the background. They want to know that they're going to happen. They want to have some faith in their EV. They want to know that when

they wake up in the morning it's going to be fully charged and ready to go to get them from their point A to their point B, whatever that is.

But this is not an exercise that they want to manipulate daily. And 15118 allows that to happen. The consumer can actually, at the point of sale he can set and forget whatever his specific specifications or preferences are in his vehicle and just know that the vehicle is always going to be available and ready for him when he needs it.

Next slide.

So in the interest of time, 15118 enables the desired customer experience via a standardized communication between the EV and the EVSE. And we as Daimler support that fully.

Thanks.

MR. SOLE: Thanks. Yeah, so a quick introduction from my side. As Noel already said, my name is Barry Sole. Despite what it says on the card, I don't actually work for Volkswagen, I work for Porsche, which, of course, belongs to the VW Group. I'm privileged enough to be here today to give you a statement on behalf of the VW Group.

Noel, if you could go to the next slide?

When I talk about the VW Group, I'm not talking about the brand Volkswagen, I'm talking about the collective of OEMs which makes up the group. We're over ten OEMs, and

we're all fully in support of ISO 15118.

If you could just go to the next slide?

What we plan or are planning to do in the near future is really we have a strong push towards electro-mobility. It is a core pillar for our overall strategy within the group. And as you see from the slides, we will produce over 30 pure electric plug-in vehicle models by 2025, and we'll account for 2 to 3 million vehicle sales worldwide, which will make up 20 to 25 percent of our total sales. And these vehicles will be 15118 compliant.

So again, as Volkswagen Group, we belong to the VDA. Our statement stands true. As Judy already mentioned, we fully support 15118 for AC and DC charging. We see it is also the basis for future load management on several levels. So really right down to the customer's home, it is possible to do load management with 15118. And as I mentioned already, we still start fitting our vehicles with 15118. It does not mean that tomorrow we will have all our vehicles with 15118 supporting all features, but we will start and build up our repertoire of features which we can and do support.

What we don't want to see is an extension of really low-level signals like PWM. And we see benefits of using 15118 over SEP 2. I think Judy already did a good job of explaining some of those, such as plug-in charge and e-

roaming.

MR. CRISOSTOMO: Just to clarify technically, what is PWM, and why is that bad?

MR. SOLE: Oh, so pulse width modulation is really sending -- you can send really one signal to the vehicle, which is basically a maximum current. There's no charge planning or anything. The vehicle will really basically start charging. And the EVSE can basically tell him, you can now charge with X ampere per face (phonetic) -- sorry get a big mixed up here with English and German. So it's a really simple way of controlling the charge, but there's no planning involved. You can't communicate prices. You can't delay charging. It's really just telling the vehicle, okay, you may not draw more than ten amperes.

You can also only do that. For us in Europe, it's a problem as well because you can only send one signal, so it has to be the same for all three phases. While we're able to charge with three phase in Europe, it's inefficient. We could charge asymmetrically if we had the details available, which will come with ISO 15118 addition, too.

Okay?

MR. CRISOSTOMO: Thank you.

MR. SOLE: All right. Good. So that's basically the statement from the VW Group. You know, we are fully in support of 15118. We will start implementing it. And we

are going to build up the number of vehicles we sell per year using this.

But there's another issue which I just want to really touch on. It's more a concept. And for us, it's not just vehicle-to-grid integration we should really be absolutely considering here. But it gets a bit broader than that. We also need to consider other large consumers in the house.

This is really just an example. If a fridge really needs to be controlled in terms of load management, that's debatable. But things like the boiler, the heat pump, the AC pool pumps, really big consumers, we could and should integrate and manage them in a similar way to the vehicle.

One of my main motivations for that is if the vehicle is the only intelligent consumer in the house, it's always going to be the loser in terms of priority. It means every time the boiler switches on, every time the AC switches on, the vehicle or the home cannot do anything else, except tell the vehicle you have to charge with a lower capacity now, lower power. This is not ideal for the customer because some days charging may be more important than heating because he needs to leave early. Other days heating may be more important than charging because he only needs to leave in one or two days' time, for example, on the

weekend.

So it's just something I really want to plant in the background is that we should also think about beyond the EVSE, so clear statement from our side, EV to EVSE, we want 15118, and we believe it should be standardized. But we should also think in terms of other big consumers, how do they play into the whole grid integration game?

And in this example here, we see a home with a smart meter and some kind of energy management system kind of deciding which device should turn on and when to avoid blackouts or to optimize costs, and there's two ways to do it. This first way we see here, the HEMS, or home energy management system, needs to know a vast amount of detail about every consumer. When can I pause this device? When can I restart this device? If I restart this device, what state will it be in? It needs to know this about every type of consumer. It needs to know this about every model from every manufacturer. It's simply not possible.

It could be that I have such a system and it's working, and I have a Bosch heat pump and they realize, oh, there's something not so awesome in the foam where they make an update. I need to then update my HEMS, that it also understands, how can I manage this device with new parameters?

Noel, if you'd go to the next page?

A much easier and simpler way to do that is really have everything price based. That means control big consumers in a similar way to the vehicle. Distribute the intelligence, not in the energy management system, but really in the end consumer. And send them price incentives to either charge or consume energy earlier or later or with less power, depending on what they can. This way the HEMS doesn't need to know anything about the heat pump. What is the maximum or minimum that it can consume from the grid? All it has to do is start playing with price elasticity.

If it increases the price a certain consumer will say, well, you know what, it's worth me waiting half-an-hour to charge. Because the difference between one or two degrees Celsius, the customer is not really going to notice. And he's home and the vehicle is, for some reason, really pushing to charge at the moment. So you have this autonomous prioritization of consumers in a home, all based on price.

And this can also be scaled.

If you'd go to the next slide, Noel?

So on the left column there I basically have the home example. Somehow coming into the home, let's say through a smart meter, you have some price information coming in. It can be real-time, day-ahead forecasting, it doesn't really matter. And this gets basically sent into an

energy management system, which then distributes prices to different consumers, getting them to either charge earlier, later, less power, more power, it doesn't really matter. It just consumes price.

Going to the next phase, we will need something similar like this for high-power charging parks, these HPC. In Europe, we are rolling our high-power charging infrastructure, I think 400 or 450 sites across Europe. And these will also need some kind of load management.

And this can be done in another way. It could be that we give the customer incentives over 15118. Well, there's really a huge load on the grid on the moment. I'm going to increase the price per kilowatt hour per kilowatt of power that the vehicle charges with. This way some customers will say, you know what, I can charge a little bit slower and leave 10 or 15 minutes later because I'm having dinner here anyway. Other customers will say, no, I'm prepared to pay a higher price because I need to be back on the road as soon as possible.

And the last is really how that integrates into smart grid. The message which I really want to send today is, yes, VW, we're going to support 15118. We should also think about in this group there are other devices which should also be integrated into smart grids, and the smart grid should really be a price-based system. What we want to

avoid is that the utilities send signals directly to the vehicle, telling it to charge now or don't charge now. This is really not good for the end customer.

An example would be in his home at some point he has a smart grid, maybe he has a home energy management system. The utility sends a signal to the vehicle, there's a huge load, you need to reduce your charging power by ten kilowatts. The vehicle reduces its power by ten kilowatts. The HEMS doesn't know why. It offers this additional power to the heat pump or the AC, for example, and it kicks on and consumes six or seven kilowatts. So in the utilities attempt to save ten kilowatts, he's really only saved four or three kilowatts.

This is why we should really, from the onset, think about other large consumers being integrated into the grid.

All right, and sorry, as policy, I must show you my disclaimer. Please read it all before leaving the room.

Thanks.

MR. DAVIS: Okay. Thank you, Barry.

And thank you all for sticking it out here after a fairly lengthy discussion of all this technical data.

This is a special day for me because I've been hoping to see the State of California push this agenda forward, and do so decisively, for quite some time. And I

think I speak for all us, that we're all committed to accelerating e-mobility as a method of solving some of the challenges in front of us.

But before I get into my prepared comments, I do want to say that I've heard a lot of things today. And one of the things I think is important to emphasize is that the OEMs have a real concern in some cases that they get pushed into doing something before they're ready.

I think that what the wisdom of the Utilities Commission ruling was is to say the point of regulation is not the vehicle, the point of regulation is the charging station. And that regulation is meant to lay the foundation for automakers that are planning to implement these vehicles with this ISO standard, as the guidance and the ruling suggested that the utilities conform to in their investment plans.

The barrier to do that is going to leave us with stranded investments. We're going to have to have a common, unique standard, and I'm going to start talking about why.

So, Noel, if you could go to the next slide?

So what is our -- I think you begin each day with the end in mind if you're trying to do something successfully. And here's where I try to capture the vision for California's smart charging. And it's a future where the highest level of cyber security is maintained at all

times. In other words, we can't risk bringing down the house with cyber security gaps.

Number two, any plug-in electric vehicle owner can safely plug in AC Level 2 anytime and anywhere and be dispatchable as quote unquote "certified resource."

So, Delphine, that ought to make you and your colleagues and Jill, make you happy. Because we want to be able to create and destroy millions of DERs every single day without confusing the consumer.

Then number three, that helps electric system operators maintain reliable service cost effectively while achieving our state RPS and GHG reduction goals, again, seamlessly, without confusing the consumer. They don't want to know about this. They don't want to schedule their energy. They want the vehicle's intelligence to do that for them, as Judy pointed out. Or impacting their transportation needs. In other words, they didn't buy this car to be a DER. They bought this car to get from A to B. So that user experience has primacy over all else. And then in a way that lowers their total cost of ownership.

So in other words, I think that Dave was right on to say, hey, it's time to have some VGI incentives that are real and meaningful and can be translated easily to the consumer so that the consumer and the OEMS can understand them, either as the OEM passing those along or as the

consumer receiving them.

Next slide please.

So I'm going to pass the baton briefly here to Stephan Voit, my colleague from Germany. Back in 2008, Stephan was the original Joint Working Group member that filed with the IEC to create the standard, and has been -- you'll go a long time in your life before you meet somebody who knows more about this than Stephan. So I'll turn it over to him for the next few slides, and then I'll come back.

MR. VOIT: Yeah. Thank you, Steve, for the introduction.

So my former employer RWE is one of the largest utility companies in Europe. And therefore, I have also had on the utility side, just imagine 1 million electric cars with a 10-kilowatt charger, 15 percent of them directly connected to the grid, that makes the power 5 gigawatt. And if you put them on, you will get a blackout within ten seconds. And if you put them off, you will put the energy on the cooling systems of the power plant, so that's not that critical. But you see, it has a high impact on the grid. And therefore, security on the grid is one of the major things.

On the other side, climate change and producing of more renewables is another thing. Renewables are normally

fluctuating. So not in Southern California, but even here, you can see clouds on the day. And therefore, you have to decide every day, charge at noon or not? And so we need to control the demand, of course. And, yeah, that's more or less all of the ideas we had.

When e-mobility will be successful, we need to have standards which agree on these requirements and which respect these requirements. And there a lot of other things, like it shouldn't be that cost intensive.

So don't put in a lot of additional stuff, and that was the idea of using the controller which is already in the car for doing the battery management and charging management, and using a small controller which is in an EVSE. Just let them talk and let them make everything, and let them make it on the highest security level we can provide. So information technology or computer science knows how to make it on a safe way. And, yeah, so adapt these functionalities for the mobility sector.

That was more or less the ideas the background.

And then the opportunity to give additional lines in the system or use the existing lines. And we decided then to use a controlled pilot signal, SAE J-1772 or the international version of IEC 61851. That should be the basis, more or less, communication or signalization on the ground of a communication protocol. Because then we are

obviously able to charge the legacy EV cars which don't have any 15118. So we need to have, of course, an opportunity for charging infrastructure also for these cars.

But then on the high level, we need a more high-sophisticated thing like communication, (indiscernible) direction of communication. We need perhaps a little bit more bandwidth for future things like exchange multimedia data with car and your home Vex (phonetic) server. Put in files like MP3s or videos in the car.

So that was the design. We say, hey, we need a little bit more bandwidth. Use the PLC technology that can be done with the already existing cables. And, yeah, then we talked to a lot of these chip manufacturers and figured out Home Plug Green-Phy could be a solution for this, not too expensive. So if you buy about 1 million of these chips, then you get a good price of $1.00 to $2.00 a chip, that's very easy. And, of course, it's one of the major protocols in the world for home internets and has already cyber secure algorithms inside. So doing a pairing, and you have more or less a VPN between both communication things.

So a lot of ideas we had on this 15118, and put it into the standard.

So next slide please.

Just a little bit older, this slide, but you see, we are doing different project teams. And every project

teams is more or less responsible for a part of the document. It's not really correct at the time, so we are just doing Edition 2.

So PT 1 is now led by a guy from EDF, a French utility company. PT 2 is led by Honda, so Japanese car manufacturers. PT 3 is more or less done. But instead, we have PT 6 which is dealing with Wi-Fi communication and all of the impacts and the difference to the wire-based communication. Then we had PT 5, the green one, which was dealing with security. So a guy from BMW led this group. At the time, we had done all of the analyzers on the Wi-Fi security issues and put it into the documents. Then we had Project Team 6, which was dealing with conformity tests and interoperability.

So just to give you a small overview of the standard, the Edition 2 was initiated to directly integrate the Wi-Fi communication into the existing documents and don't have Wi-Fi. That was the first idea, don't have Wi-Fi, in several documents. So just integrate them, that would be much nicer. And of course, we take some additional features into account. So as Siemens is working on, what to call it, trucks and heavy-duty cars, or I'm not sure what the quick -- the name is --

MR. CRISOSTOMO: Heavy Duty vehicles.

MR. VOIT: -- Heavy Duty vehicles or buses. And

we get also a little driven from the Japanese idea on CHAdeMO having energy feedback, so getting electricity out of better retail or whatever, put this also into the standard. The last thing would be very complicated because nobody really knows how to do energy feedback to the grid.

In Germany we know a lot of things about this because we have a lot of photovoltaic, like 40 gigawatts of photovoltaic feed in. And we know a lot of problems on feedback to the grid from the other side. So the grid is designed to get it from the power plants to the end customer. And now we're reversing this way, and that leads to a lot of safety issues, of course.

Okay, next slide please.

MR. CRISOSTOMO: Could you clarify what CIPT means up here?

MR. VOIT: Ah, so the total name, maybe this is a good explanation -- or a good question. The working group, which is developing 15118, is an ISO/IEC Joint Working Group, vehicle-to-grid communication interface, and that's V2G CI. And the standard was decided by ISO and IEC to be -- do a logo name -- sorry, do a logo standard, so those logos of both international standardization organizations, IEC and ISO are on the standard. But it's published as an IEC standard, but you can also buy it at IEC. So that's a little different. So the name of the standard is ISO 15118,

and the Joint Working Group is ISO/IEC Joint Working Group. A complicated thing. And vehicle-to-grid communication interface says more or less what we are doing.

MR. CRISOSTOMO: And what is a PT? I'm sorry.

MR. VOIT: Project Teams.

MR. CRISOSTOMO: Project Team. Thanks.

MR. VOIT: Sorry. Okay.

Within the 15118, because it's a protocol defined between EV, which is on the left side, electric vehicle, and charging infrastructure was the gray box on the right side, therefore we called all of the items we have to address within the standard as primary actors. It may be the charger, the battery management system, human machine interfaces, a meter and whatever, conductor on the EVSE side.

But we also know that there are secondary actors. So other roles where we have communication with, that may be the ChargePoint operator, of course. So we have to -- he has to monitor and do a lot of things with his ChargePoint. So we know, hey, we need to perhaps sometimes in our authentication of this ChargePoint operator, and therefore we also integrate 15118 data structures and things like signatures and encryption and decryption methods and precisely define what kind of systems you should use to communication with a transport operator. And the same is

done for the grid and for the e-mobility service provider. So that's another sense of the 15118. The one who has the end-customer contract. And, of course, getting pricing schemes to the EV that the EV can decide when to charge.

All of these communications are not described within 15118, because it's a protocol between EV and EVSE. But the data structures are defined which are going to the backend roles, so the secondary actor roles. And there are just some ongoing projects on defining protocols for this backend communication. So my colleague Craig Rodine has done a new work item proposal at IEEE. There's a new work item proposal at IEC. And there's a single start of one kind of (indiscernible) protocol for the charge point operator at OASIS with OCPP. So you see, the steps behind are just, yeah, in development and figure out. And we hope that we get the things together. So OASIS already agreed on having a liaison with IEC and over the work from OASIS sometimes to IEC so we get an internet standard on this.

But there are a lot of open questions, like how to integrate millions of smart grid? And why there are no existing and accepted smart grid standards accessed worldwide? One of the reasons we adopted 15118, some mechanisms which you can use in the small grid worked, and you can make gateways and assume. So we already made a gateway to OpenADR. There may be gateways between 15118 and

smart energy profiles. I didn't test it because Smart Energy Profile is not relevant to the European market, and I'm now very new to the U.S. market. So I think it would be also a good idea to have a good look at this. And I think within three months or so you can get a specification on how to exchange data between 15118 and Smart Energy Profile Board (phonetic).

And that may cause other standards, like 61850, which is more or less describing object models and the utility environmental, and EDF, so the large -- I think it's the world's largest utility company, they can show you also 15118 between EV and EVSE, and then 61850 from the EVSE to all of their systems in the background. So that's already done. That can be seen in Paris on the left. So you'll see it. It's working together.

Next slide.

Yeah, I think most of these things on this slide already tells you. So reliability, of course, we heard about backend communication. We know cell phone providers are normally working. But even if you have a heavy load, you get delays and you have to have automated usage of the data you have locally, and then find solutions for that, scalability, low-cost service, security we've already talked about, and simplicity for the consumer. So plug-and-charge is what -- some people are talking now the Tesla model, so

plug in and your car will be charged. That was done already in 2009 with Daimler cars and (indiscernible) charging stations, so that's not new. And that's, of course, the base of plug-and-charge in 15118.

So that's simplicity for the user. And the user doesn't have to know anything about the grid because the only parameters is I want to departure at 6:00 in the morning and my car should be filled up. That's the only thing that a car -- a user should be doing. It can provide it as a quick leave profile perhaps, then you don't have to do anything more, only, hey, today, evening, I need it much earlier than next morning. So that's done in the 15118 already.

Next slide.

And just a short overview, 15118 was made by nearly 140 registered experts. Certain countries developed actively on this standard. An additional 40 companies were reading the standard and doing comments on this. And you see, it was -- one of the standards was a lot of -- the most written comments on it, so get it really worldwide working, getting PAC technology accepted by China and Korea and whatever. So it's a really widely accepted standard. And even for the OEMs, the car manufacturers, it's relevant to have one standard which is working worldwide and don't have national standards to respect, so that's easier to

implement.

Next slide please.

Yeah, the CCS. We heard a lot about CCS in the morning. So combined charging system for DC is based on 15118, of course. The DIN Specification was a shortcut to give us. In Germany, it's a kind of technical report. And it allows you to bring cars on the market or EVSE on the market. And more as a short track, you can get a DIN Specification within six weeks. And then all of the work from the DIN Specifications was handed over in 15118. So all of the DIN SPEC was 100 percent 15118. Then we had to comment phases, one on the DIN SPEC and one on 15118. And then we missed a little bit to put in all comments in the second edition. But this will be done now in the second edition of 15118, so Edition 2. And then DIN SPEC will be killed or rejected from the market. Volkswagen Group already exchanged the protocol sticker on the cars from DIN SPEC to the final version of 15118, Edition 1. Other car manufacturers may follow on this.

So if you have a DC implementation on 15118, they're normally also done for AC. There are two additional very easy messages. And all of the hot -- one is real-time protocol sequences for DC charging, so control with the off board charger, you can throw out for AC charging, and then you are mostly done. So a very, very easy thing. Everybody

who has CCS in his portfolio can also have AC Charging.

MR. DAVIS: Thank you. Okay.

So once again, just to really bring this -- go quickly through this, the heart and soul of smart charging is a couple of little pieces of data, which 15118 accomplishes by getting the needed kilowatt hours and departure time from the vehicle. The needed kilowatt hours, it's not state of charge, it's actually how many kilowatt hours. Because state of charge could say 50 percent, could mean different things to different vehicles. And then departure time enables the vehicle to receive a tiny little file called a tariff table. And then at that level it's basically the vehicle's intelligence of selecting when to charge and how much energy to charge at what power levels.

So it's taking the grid and saying, okay, primary is the range needs of the vehicle owner. And so the vehicle is actually the master in the relationship, and the grid is actually the slave in the relationship. So when the vehicle selects its grid plan and prices, unless there's something really bad going on with the grid, you can't take that away. And that's an interesting aspect of this. This is one of the reasons why my colleagues here like this standard. It protects the EV owner.

But at the same time, as we mentioned before, we create a DER model that makes these vehicles dispatchable,

re-certifiable resources that can come to the aid of the transmission system operator and be bid into energy markets. So we have something that gets us past the L.A. Air Force Base thing where it took a year-and-a-half to figure out how to bid things. We don't -- that won't work. That doesn't scale. So again, standards is the way to go.

Next slide.

So, yeah, this is, again, we're trying to deliver a complicated thing where you see those P-Node prices that are all over the map in the State of California. Some of them are bright red which is over $200 per megawatt hour, and some of them are bright blue which is under negative $50.00 per megawatt hour. We need to deliver that accurately. And when we look at that slide, each one of those dots is kind of like a galaxy.

Down beneath that -- next slide -- we have a deeper picture where we can see high penetrations of PV and a distribution where have not a duck but little ducklings. And you need an intelligent methodology of scale to take to that scalable data and give them grid profiles that enable it to harmonize with what's going on locally, as well as regionally and statewide. So we did a study of that in 2015 and found that the standard worked beautifully to enable that to happen without compromising anybody's range needs in a simulation scenario.

Next slide.

The demand clearing house, as Stephan said, we've built one. It is -- I've heard it said that that's little old Kngrid, or Steve with, you know, one guy with a wheelbarrow trying to monopolize the market. That's not true. This is an open standard. Anybody can do this. This is not anti-competitive. This is not a power grab. This is trying to move the ball down the field and help this work.

So, yes, we have this working and we're able to do this. My wife is able to smart charge her car because it has 15118 on it. She enters departure time, and we are getting the 15-minute market delivered to the vehicle, and the vehicle responds as you would want it to respond.

Next slide.

So, yeah, you get a power level table and sort of a relative price table that the vehicle then sees and makes an optimal selection from.

Next slide.

Yeah, so we do have that up and running now. We're taking prices from the CAISO's OASIS system in the 15-minute market and the day-ahead hourly market. We also have an OpenADR 2.0b virtual end node that we're able to receive demand response signals and can send those curtailment signals in the form of a 15118 tariff table.

So there's no issues here. And a demand clearing

house is something that is, you know, available at fine cloud-based solution stores everywhere. You would be able to build one yourself or license one for most software providers. But utilities would be able to basically have these or a thin client version of this for themselves and enable that to scalably handle the data.

Next slide please.

So here's the actual demand clearinghouse user interface. You can see a charging session there. I think that one was at UC San Diego where we have quite a few of these vehicles in place and where we were sending, I think those day-ahead hourly prices. So you can see the shaded blue area would have been uncontrolled charging. And the blue line is what was actually selected by the vehicle, based on the price dips, which you can see in the yellow line above.

Next slide.

The reason I think we have a lot of compelling evidence to say that the 15118 makes sense for California is because of, Carla, your earlier comments, that this is a global signal. We are not going to solve climate change by ourselves. We need to be the tent pole for other countries around the world to follow what we're doing. And we have global players in the form of automakers that are trying to deploy these products, not just here in California or

nationally, but worldwide.

I do take Adam's point very seriously, that he has a telematics solution right now. But nothing in the investment plans that would include 15118 charging stations would stop him from continuing to dispatch his vehicles using telematics.

So next slide please.

On top of that, I did want to mention, at Marrakesh just recently, Germany and the California Environmental Protection Agency jointly agreed to expand cooperation on climate and the environment, and agreed to, you know, expand cooperation on renewable energy, energy efficiency, and climate-smart technology. So again, we had a historic moment in Paris in December of 2015, and that was a great moment for planet earth. We all got together and then we ratified that at the U.N. in New York. But the whole purpose of that was not just to go back to our countries and start going back to business as usual, it was to change the game and to begin to collaborate with global solutions to this global challenge we face.

So I understand, when I say things that are provocative, like, okay, we're out of time, put our pencils down, it's time to act, because we've been having this stalemate now for several years, and it's time for us to, you know, quickly bring this debate to a conclusion and move

from paralysis to action.

Next slide please.

And just a closing comment, you know, successful movements and companies always start with why. And looking there, you see somebody who knows how to sell a message. Well, he was selling a product there. He was selling a product he didn't even have, and he sold a lot of them, and he started his first five minutes selling that product with why, and that works.

Apple does that too. They don't say we build great computers and we do it with elegant designs and great user interfaces. They say everything we do we believe in challenging the status quo. We do that with elegant designs and compelling user interfaces. It starts to feel like an extension of who you are. We just happen to make a computer. You want to buy one?

That's different. And that's what he's doing, and that's what we need to do as the State of California, even as a government, we need to bring on the revolution.

And so I'll close with this. This is the last time I'll be appearing as KnGRID. We're changing the company's name to Oxygen Initiative because we're going towards commercialization. So a little reluctant to say goodbye to it because I've been doing it for so long. But anyway, I thank you all for your time.

MR. CRISOSTOMO: We're going to go to a WebEx question. Sam, so if you could turn on Max Baumhefner from NRDC.

Go ahead, Max.

MR. BAUMHEFNER: Hi. Noel, can you hear me?

MR. CRISOSTOMO: Yes. Yes, we can.

MR. BAUMHEFNER: Okay. Great. Thank you.

So first off, I just wanted to know to lend my support for the goal of this whole enterprise to, you know, accelerate vehicle-grid integration, which I think is very consistent with the goal of the State of California by adopting SB 350. And thank the PUC for kind of forcing the issue a bit.

I'd note that I don't think I am particularly well positioned to choose the right technological pathway. And I'm not yet sure that the PUC is prepared to do that either. However, I would note that the PUC is singularly positioned to set a goal and provide a market opportunity for the right technological solutions to emerge. And I think other presenters have shown this throughout the day. And it strikes me that making VGI or V1G an eligible resource within the Commission's existing energy storage procurement mandate would be the single quickest way to create that market opportunity. We would note that the PUC asked earlier this year whether to revisit the eligibility of V1G,

which is identical to ice storage from a physics perspective in terms of its functions and the support services it can provide to the grid.

And then I'd just note that it's hard -- I think a lot of the presenters made a lot of compelling cases today. And we'd just note that we have to also keep in mind cost and ensure that we're not locking ourselves on any particular technological pathway that would cost more to implement than the value of the grid services it could provide, or the economics of all this could fall apart very quickly.

So I think we need to keep multiple technological pathways alive, both those that use so-called smart networked charging stations, and likewise, those that rely upon cheap reliable dumb charging stations and take advantage of smarts that are already embedded in the vehicles, like the one that Adam presented earlier.

So with that I'll close, and thank Noel and the rest of the those who have organize this very informative presentation today.

MR. CRISOSTOMO: And our next questions, we have a few minutes before we need to go, Craig, then Mike, then JC, Nikki, and Dean.

MR. RODINE: Commissioner Peterman and everyone else, thank you very much for the opportunity to talk. I've

really enjoyed and been stimulated by a lot that has been said so far.

My name is Craig Rodine. I'm Director of Standards at ChargePoint in Campbell, California. I've asked the support folks to bring up a few points. I think I don't have more than just a few moments.

If you could that in presentation, then we're off to go. Ready to go. Thanks. Next slide.

So I just wanted to summarize ChargePoint's perspective right now. We think that the 15118 series of standards is ready to go in terms of being a viable technology, not only for what's happening now. As you've heard, it's the fundamental core of DC fast charging today that's being deployed all over the country by multiple service providers on multiple OEM vehicles, including some made in Detroit. But I'm involved in the standardization efforts where it's looking forward to wireless charging and advanced features like two-way energy flow. So from a standards point of view, it's the real deal.

We're investing in it, not only be participating actively in the standards, but also in an R&D project funded by CEC where we're putting this communication's interface on our home product. And we're able therefore to deploy that into all different utility VGI programs. And we're well involved with SDG&E on theirs, as well. So we believe it

will land there.

We're also keen to point out that we usually do things because car makers tell us to do it. You know, we're not in charge, so to speak. And we know that the auto OEM roadmaps, as you've heard, all include this DIN and 15118 technologies. So we're not risking a whole lot in saying that it's solid.

We do know that the way the standard is written, there were some initial business models, including a utility role, which no surprise, it doesn't match what's here five years, six years later in another environment in California. I'll have some cartoons that show that very clearly and what we think we can do to tame it, if you will, or to embed it into what we're doing, particularly the roles and motivations of site owners and service providers are, let me just say, inadequately defined. We don't think that's a show stopper, but we think that we can help with that.

And then finally, transitions and scale matter. I know that a lot of times we look at these standards and architectures as though they're running and they're at massive scale, but there's very important things to consider in the transition.

And I just want to point out that if you look at the number of kilowatt hours in batteries rolling around in cars today and the vast majority of them are from a

proprietary company that we just heard about, and that may continue to be the case if they sell as many vehicles as they look like they're going to do so that nothing we do here will effect that until and unless they get onboard. So we will always have non-standardized cars. And our job is to charge every car and offer as many of those batteries to the utility for their purposes as possible. And this is why I'm saying the network is still very, very important.

Next slide please, Noel.

You know, I picked this right up. And I just want to say that that's sort of a very partial view of things. That's not the scope of 15118.

One more click.

That's the scope of 15118 going from the vehicle through the station, the charging station, and all the way back to a secondary actor. And as I said, the work that was done primarily by RWE and others was to think of the utility offering prices for energy. There are many other services that a site and a network can offer the driver. But this is really what I think the current scope of Edition 1 is.

Next slide please.

As I said, the role of these secondary actors and the number of them and the pathways that you can follow to get to them is rather loosey-goosey. So this other set of dotted lines could show communication pathways from the PEV

to using 15118 to various actors, as well. I just wanted to point out that that's the work that has to be done.

Next slide please.

So this is what our CEC-funded project looks like. We're supporting the part of 15118 for AC charging between the electric vehicle and the charging station. We're communicating what needs to be carried from our charging station through a network connection to our cloud, which is 15118 payload and supports all the use cases that they originally came up with, and could indeed go all the way back to the utility. We think for technical and practical and business reasons that we would be the secondary actor and we would terminate that -- we would serve those 15118-capable cars, while serving all the rest of the EV plant. And we, like many others, are using OpenADR 2.0b as our energy management interface with the utility. So we would take those signals as they're being used for commercial and industrial DER today.

We're actually involved in creating new signals that have to do specifically with EV charging, because that's kind of an unknown territory. And in those signals you encapsulate all of the motivations of the driver, the site owner and the utility. So we're working with utilities to do that, and we think OpenADR 2.0b is the right interface for that.

That's pretty much what I have.

Oh, and I would just say that the actors on the left or the boxes on the left there we've found not to be relevant. There was a plan that the AMI meter would have a home interface. There's a plan for separate energy services interface and home energy management systems, but everything seems to be going up in the cloud, including the most successful home energy management solutions right now, with a little bit of local connectivity. But, for instance, our home station isn't required to connect to anything else on the site, it goes to our cloud. And that's a very efficient and direct way to do a lot of the emerging business cases, is to do it cloud to cloud, so that's how we're oriented.

I think that's all I have to say. And I would just conclude by saying we see no technical show stoppers. In fact, we're excited to use 15118 and promote it, you know, well, to promoting it in the sense of technically implementing with our OEM partners. We do think there's more work to be done.

And then to the point of value and figuring out what this is really -- all the economics we've been talking about, I'll just -- this is a personal challenge to the industry. Let's make an open source, completely available model, it could be an Excel spreadsheet, that has the ability to turn up and down the number of EVs deployed,

where they're deployed and their concentration on grid elements, like a circuit or underneath a substation, the customer/driver and site owner incentives and the percent participation so we can dial that up and down, and then value of the -- the dollar value of those DER and energy services, if we have that we can start looking at how many cars are sold, the empirical evidence of which drivers buy in for how much money. And we can really understand when the grid is going to be impacted, and how.

With that, I'll conclude my comments, and thank you again very much.

MR. CRISOSTOMO: So it sounds like we're transitioning mostly into the next half-hour. We have 22 minutes, and I saw a ton of hands. I also received a pre-made public comment from UCSD.

So if I could see the next set of hands, we can allot that in the next 22 minutes, please. Hi. Okay. So I'm going to just move from the right to the left.

Mike, Tyson, so let me just get everyone's names down.

Adam, Dean, Nikki. I'm just -- so I'm flanked. Tyson first.

COMMISSION PETERMAN: I just know, I need to step out, but there's lots of PUC folks in the room, and I will be back. And I look forward to hearing more.

So, Amy and Mel, particularly, take good notes in the next session. Thank you.

MR. CRISOSTOMO: So please keep it brief. We have six, and starting off with Tyson.

MR. ECKERLE: Great. This is a quick question, actually, for Craig.

For the stations that are 15118 enabled, is there a considerable additional cost, or what's that? Is there a way to answer that without --

MR. RODINE: As well as I could. It's not a big, I'd say substantial bill of materials change. I think the cost is in the experience, I mean, going to these standards' bodies, implementing the software. Luckily, we got a very generous grant, and it's pretty much covered for integrating that into our newest station. But it's not, you know, a blocker for commercial business, even on a small $500, $600 home station.

MR. CRISOSTOMO: Okay. Mike?

MR. BOURTON: Mike Bourton, Kitu Systems.

I just want to go back to the cell phone analogy because it's as simple model, it's proven to work. And we're actually constraining ourselves if we're not careful because I think it's the underlying architecture we should be discussing. The cell phone's got 100 apps or more on this phone. I can tell you it's talking to 100 or more

servers. And it's probably using 30 different protocols to do so.

It also has many interfaces it can talk over, and there's each a use case for each of those interfaces. When I talk, I can talk over a cell, telematics. I can talk over Wi-Fi, let's call the EVC/POC (phonetic). I can talk USB. I can talk Bluetooth. And my amps work over any of those interfaces. And the reason it works over those interfaces is because it actually makes a connection, not to the intermediate device, but it makes it to the end device server.

So, for instance, when I join a Wi-Fi access point with this device, I do communicate initially with the Wi-Fi access point. But I then, once approved to connect through, connect to the server of my choice. That means it could be the utility, it could be an aggregated, it could be EVSE service provider. In the future it could be a neighbor, where I'm trying to buy energy from. But what I don't do is I don't force the protocol to be between here and the Wi-Fi access point. That is a limitation. If we did that, this phone would not be in your pocket today.

Because the success of this phone, it's got a billion apps. And they all talk different protocols, but the good thing is we make a connection, once we get to the Wi-Fi access point, between that and the server. So making

a constraint over that and the Wi-Fi access point would be dangerous.

And another point I want to make is if we did so, then there is a cyber security issue. Because 15118 defines between the EVSE and the EV only. When it gets there, we talk about a different protocol. That means we have to decrypt the channel and re-encrypt it to the source. That is a cyber security issue. (Cross Talk) Yes, it is.

MR. CRISOSTOMO: Okay.

MR. BOURTON: Because it only could be understood by the two parties involved, which is the utility and the electric vehicles.

MR. CRISOSTOMO: I'm going to have to call moderator's technical conversation for after -- now because we have five people. And, sorry, before Adam, UCSD submitted a comment, and I promised them before.

Where's Byron Washom?

John, maybe like three minutes? Sorry.

MR. HOLMES: And actually, I'm going to be even less than that, so I'd like to be very efficient about this.

Just simply to state that the ideology behind 15118 is essentially utility-centric. It's been brought before us with great success due to the dedication from the European contributors to that standard. And the ability for it to accelerate this whole process forward to achieve

statewide goals is essentially the fastest path toward implementation, and we need to track that. I'll cite previous examples of TEPCo's involvement in CHAdeMO, RWE, in like fashion accelerated the focus, made a three-year effort, and has delivered essentially a fully functional implementation. And the ability for that body of work to influence the global stakeholders here, I think is significant.

So we're very appreciative of all of the efforts that have come forth. We are very fortunate at the UCSD to be the first North American demonstration site for 15118. And we're looking forward to accelerating that even further.

MR. CRISOSTOMO: And this was going to be included in the record.

MR. HOLMES: Well, I'll leave this for review publicly. I will not talk to more slides here in the interest of time.

MR. CRISOSTOMO: Okay. Thanks.

So the queue is Adam, Dean, Nikki, JC. And just so that we get everyone, I'm going to enforce a time limit.

MR. WASHOM: Okay. Thank you. My name is Byron Washom. I'm Director of Strategic Energy Initiatives at UC San Diego. And I come here today with a little different perspective.

I've become a site host, no different from any

other campus, airport, harbor, apartment building and condo. And I very much appreciate the comments from Ford and others on the line today about taking into consideration what the site hosts are. Because it gives me a great perspective of the needs of this industry, the standards and the needs for communications in order to optimize in the future.

Just to put it in perspective as a site host, we bought 50 Daimler smart cars this year. We have created an affinity lease program with four different vendors, BMW, Daimler, Ford and Nissan. And in the last month alone we added 80 new EV commuters to our pool on campus through those affinity lease programs. And this morning, Nissan authorized me to make the statement that they are extending their $10,000 cash rebate on sales to our student, faculty and staff for their 2016 cars, will now be applied to 2017 cars. Not only that, is they want to extend that same UCSD offer to all other nine campuses and all other three national labs that we manage. That is over 190,000 employees and 280,000 students for that particular program. And the BMW, the Daimler and the Ford Dealers are equally attractive.

So I'm very blessed and excited that the other UC campuses and national labs are going to become big site hosts, exactly like us.

But in that perspective, we also understand, and this is the point I wanted to make, is out of all of our drivers, all of our commuters, they are hungry to have more features with this tool that they have. They read about it, they dream about it and they hear about it, and dammit, they expect it. And so it's very hard for us to say be patient.

And thank you, Commissioner Peterman, for soon, 2017 will be the year we make decisions, so we can get on with it because there's a lot to be done. And when you deal with the issues of affordability, which I think we've cracked the nut now with these four OEMs. And the issue of accessibility by providing a variety of different charging stations --

(Timer beeps.)

MR. WASHUM: My time's up? Then in that case --

MR. CRISOSTOMO: Finish your sentence.

MR. WASHUM: -- when you crack the nut of affordability and accessibility, you then have the ability to have vehicle-grid integration between the fleets, the workplace and the public. Thank you.

MR. CRISOSTOMO: So Adam, Dean, Nikki and JC.

MR. LANGTON: Hi. Adam Langton, BMW. I just wanted to clarify BMW's position regarding 15118, since Judy was offering some slides and our logo was on there.

BMW does support research on 15118. We've said

that numerous times. We've filed with the Commission, I think at least three times where we've described our position regarding 15118. We do support research on it. We think there's value in exploring research on it.

We do not support the adoption of a single standard, a single exclusive standard to use for smart charging. We've said that in our comments numerous times. So I would encourage folks, if they're curious about what the BMW position is, look at the comments that BMW has filed with the CPUC in proceedings on this.

In regards to one of Stephen Davis' comments regarding what the Commission has already decided on this, the Commission, as far as I understand, and I would defer to Noel or anyone else who has been involved in this, the Commission has not determined what the resource is in VGI. They've not ruled on that.

We heard from Amy earlier saying that the Commission has not determined that it will pick a standard, that it will pick a single standard on this, that I can't, it doesn't have the record to do that.

So if there's confusion on this, I'd encourage the folks from CPUC to offer some more -- to reiterate the things that Amy said regarding what the Commission has actually done on this.

And regarding the OEMs approach to this, Stephen

Davis suggested that we don't want to do a single standard right now because we don't want to move too fast on this. And I think you heard earlier myself, and you heard Ford, as well, saying we just don't think that picking a single standard is a way to move quickly on this, that is we don't think that that is the way to move quickly. Because we think that the primary barrier to this is a pathway to get to the value, and then a defined revenue from that value. And so we would encourage the state to focus its efforts on that.

We do support the process for exploring standards. I think we've seen that there's a lot of ambiguity, of misunderstandings on this, and I think we can address that through the working group that the Commission suggested. So that's something we strongly support, as well.

And I think in addition to the time to market, you know, Max mentioned like one of the factors you want to consider is cost, and you want to consider time to market. So I think if we're considering a single standard approach that we want to universally adopt, we've got to consider what impact that that's going to have on the time to get to the market. I've shown you a telematics approach that works now and can work for thousands of vehicles immediately.

Thank you.

MR. TAYLOR: Hi. Dean Taylor, Southern California

Edison.

And in addition to my earlier comments supporting the working group to think through all the different, you know, end solutions and come up with 20 or so criteria and work through all the details, there's another thing I'd like to say that Max Baumhefner from NRDC mentioned, which is there is a solution that a very unusual coalition has been supporting for over two or three years, which is basically to add smart charging to the definition of the storage mandate. And in written comments, this unusual includes a ratepayer group, TURN, the Automaker Alliance and several individual automakers, the three investor-owned utilities, NRDC and ChargePoint. You know, that is a pretty unusual group of people, basically saying that if that was added you would suddenly have an actual real value to all of this.

I did want to, you know, emphasize that as something that's been out on the table for over two years as a way to actually jumpstart this market. I think it's a really interesting, you know, outside the box solution.

I think there are some other interesting things. We haven't talked a whole lot about rates, but rates, whether they're simple or dynamic, are also in the definition of vehicle-grid integration. I think you'll see some very innovative things coming out in the next few years as far as the, you know, time-of-use rate things where

you'll see some very low prices in the middle of the day.

I say that partly because I think we're underestimating consumers. In the last 10 years, I've been doing this 26 years now, we've seen a lot of surprises from consumers. Nobody expected that, you know, basically roughly three-quarters of the people who are charging at home are not using EVSE. They're using either NEMA 1450 cord things that Tesla uses or they're using cordsets. So they're just smart. This is a cheap solution.

And I think another thing is that people are using time-of-use rates a lot. I mean, if you're driving 12,000 a year you can save like $800 a year just going from $3.00 a gallon gasoline down to $1.00 a gallon gasoline. That's, you know, a huge value of VGI that's already happening today. There's programs in the future, like the Low-Carbon Fuel Standard, the utilities will be rolling out that will get hopefully -- one of the main intentions of that is to get adoption of these time-of-use rates dramatically up. You know, 40 percent is way too low. We need to have many more people, you know, on these rates.

And in general, I think people are just smart. They're very economic animals. A lot of like plug-in hybrid drivers won't charge at work, you know, because it's too expensive or there's too many penalties. So, you know, don't underestimate the consumer, I guess is my -- you know,

what I'm trying to say on this last set of comments here, is that that's a really big part of all of this. People aren't going to pay huge networking fees, you know, unless they get more back, which was, I think, another point that Max was making.

Thank you.

MR. COLDWELL: I've got just a quick question.

The proposal to add the smart charging to the storage mandate, was that comment submitted into the CPUC's storage proceeding?

MR. TAYLOR: Right.

MR. COLDWELL: Or is that just something that's happening outside of the discussion that's happening?

MR. TAYLOR: No, in the storage proceeding. The last round of comments, I think were filed February of this year.

MR. COLDWELL: Thanks.

MS. DELEON: Good afternoon. My name is Nikki DELEON, and I work with EVgo. Thank you for this opportunity to speak. I would like to say that EVgo has worked with a number of V2G and VGI programs in the State of California, New York, and also in Delaware. And so I wanted to address one of the comments about L.A. Air Force Base, because I think that they did something really exceptional. And while it took them a year-and-a-half, they were able to

off-board power from the vehicle and participate that electricity back into the grid.

So from my understanding, 15118 as a standard doesn't currently include that in the standard, but it would come in future versions and iterations which could be almost two years out, if not more, for what those next versions could be. So I think that, you know, really exploring what those value opportunities are, especially because we have, I think, what is it, 42 opportunities for energy storage in the market, and the vehicle is really about energy storage being on wheels. So is there a faster opportunity to incorporate that, especially within 2017?

So also, EVgo does support a workshop where there is an inclusive process to discuss all these.

Thank you.

MR. CRISOSTOMO: So then in your remaining time, Nikki, I was going to ask to try to generate conversation.

V2G is an electric vehicle technology that is currently eligible under the storage mandate. So if the SAE standards would allow for V2G capabilities, and given that market signal, why are we not seeing V2G vehicles?

MS. DOLIO: That's a good question. I believe that it's going to be a cooperation between utility access, and also OEM, and specifically driver interest. So if there's a market available, are the drivers interested in reducing

their cost of ownership through participating with their vehicle and these types of services? And with the OEMs create that type of technology on the vehicle so that the drivers could then access that type of market.

Also, about utility access, the proposed rulemaking does have some language in their specifically about incorporating SAE standards for Interconnection Rule 21 so that it streamlines and opportunity for vehicles to participate as a generator service on the grid. But there continues to be a number of barriers to participation, least of which is the communication aspect. But to continue to address those barriers so that we can have vehicles participating as the energy storage.

MR. CRISOSTOMO: Okay. Thank you.

Maybe JC can respond to --

MS. BRUNSON: Excuse me, Nikki. You commented on 15118 not having the current capability to support reverse energy flow. I would just offer that the standard will be available before the OEMs are offering reverse energy flow vehicles in the market, so --

MS. DOLIO: Nissan currently has a reverse energy flow vehicle in the market. Now, while there are still barriers with warranty on the battery, you know, the technology is already onboard the vehicle. And actually, at UC San Diego, EVgo is currently working with Honda. And in

previous projects, we've also worked with BMW. So there are a number of vehicle manufacturers who do currently offer this technology.

MS. BRUNSON: Technology is available, yes. I'm talking production, but, okay.

MR. CRISOSTOMO: Okay, JC?

MR. MARTIN: Thank you, Noel.

Thank you, CPUC, Governor's Office, CEC for this today.

I'm JC Martin from San Diego Gas & Electric. And I just want to provide some comments which are based on our current Vehicle-to-Grid Integration Project that we're rolling out right now, our infrastructure project for multiunit dwellings and workplaces.

I see three key data exchange needs for any standard, and that is basically the driver preferences and needs, the prices that they're going to have to pay, and then how many kilowatt hours they need. And I think from today, I get the idea that 15118 meets those needs, although there's probably other technologies and standards out there that can possibly do the same thing.

When I went back and looked at the ACR from November 14th for the TE, transportation electrification work, Appendix B, the multiple criterias that were laid out there, I boiled it down to three key criteria for a

standard, driver-customer oriented, it drives down costs for whatever the solution is, and it also allows for smooth integration with the grid.

So looking at it through that lens, I think it makes sense if we do think about an extra working group so that we can make sure that we can really refine the what and the how. Maybe 15118 is it. Maybe there's tweaks it needs. Maybe there's use cases we have not identified. I really think it makes sense that we can, you know, leverage what we've done in a DER proceeding, especially Rule 21. And combining all that into some standards' work, I think would really help the state and the drivers and the OEMs, and the other market participants, as well as the ISO and SDG&E's customers.

Thank you very much.

MR. CRISOSTOMO: We have 70 seconds until we need to transfer to Frances.

Any other last comments? Quickly.

And, Frances, we can start moving you up, wherever you want.

Go ahead, Rich.

MR. SCHOLER: Yeah. I just -- of course, I address this from an OEM, Fiat/Chrysler, so I'm global OEM, and the SAE standards. I do think we really need a workshop to go through this material, because I've demonstrated SEP 2

doing the things that have red xs in them on these use cases. We've already done that. SEP 2 and SAE standards incorporate everything that 15118 has and more. So we just need to work through this, and work through it collectively as a team.

So that's my comment.

MR. CRISOSTOMO: I think that's a perfect transition for our next presenter, Frances. So thank you, Presenters. You can go back to your seats.

So Frances Cleveland is the Chair of the CEC/PUC-sponsored Smart Inverter Working Group, who can provide a perspective on some of the gaps in all the things that we've been talking about today from a technical standpoint.

Thank you, Frances.

MS. CLEVELAND: Yeah. Thank you. And I'll also add a little bit to my own introduction, which I think may be relevant to this group.

One is that I am also the Technical Editor of IEC 61850 for DER. And we are also hopefully having a joint working group with TC 69 (phonetic), which is the EV group, where hopefully we will get some of these things worked out. This is, of course, at the IEC level, which takes forever to get anything done, but nonetheless I think is an important aspect.

In addition, I wear the hat of being convener of

the Cyber Security Working Group in the IEC for the utility arena. So cyber security is indeed part of this whole effort.

So what I'm going to do today is basically, first, just go through a little bit of what we did and the background to the Smart Inverter Working Group, because I think it's an important example of how we can possibly get things done. Maybe it will fail, I don't know. But at least it did seem to work for the interconnection of distributed energy resources.

And so then I'm going to, first of all, I'm going to act essentially neutrally in the sense that I'm not advocating expressly any particular way to go or particular standard. I have my personal opinions, and I'm sure people know them. But what I'm trying to do here is present it as if, okay, we've got to get all the stakeholders together and see where we go from here, and let the stakeholders sort of drive the effort.

So starting off with the Smart Inverter Working Group, this started up partly because we first had the goal of achieving 33 percent renewable energy by 2020, which amounted to about 12,000 megawatts of DER, distributed energy resources. Now that mandate has been upped to 50 percent by 2030. And we are well on our way to getting there. So the key issue is not necessarily getting there,

but how we get there and what the implications are.

So one of the things that we determined early on was the fact that DER, and I think this is the same, true, for electric vehicles, are not just a problem for the grid, they can help solve some of the problems of the grid. And so I think that if we think of it in those terms, then we can see what a good approach might be.

So getting back to the Smart Inverter Working Group, one of the things that we saw was some problems that they had in Europe. There was a big blackout in 2003 in Italy caused by Germany, Switzerland, and a few other things, where they began to realize that they had to request DER systems to do a little bit more than just sit there generating power when they felt like it and shutting down when they felt like it, et cetera. It was a very expensive proposition when they realized they had to retrofit a lot of these systems.

So from the DER perspective, California, both the CEC and the CPUC, didn't want to repeat that, so they started up the Smart Inverter Working Group. We started up 2013 with basically an idea of updating California's Rule 21. We ended up -- we started off with maybe ten participants.

And I will have to say that the first few meetings were why am I here? This doesn't make any sense. We can't

do any of this stuff. And, you know, they want us to do this and we can't, and you want us to do that and we can't. But it was amazing how fairly quickly, once people began to sort of listen to each other and say, oh, well, if that's what you want, maybe we can do it. Now let's quibble over whether it's 0.2 seconds or 0.3 seconds. And so we finally got down to that level of discussion.

What we ended up doing is having a phased approach where the Phase 1 were seven critical autonomous functions, which are now final. They're now in Rule 21. They got approved in September 2016 and will become mandatory by September 2017. Phase 2 was -- and the Phase 1 were autonomous, and basically functions that all DERs would have to do. There wasn't any real expectation of any cost return, per se. It was basically, we got to have you do this stuff, or at least have the capability.

Phase 2 was saying, okay, well, now we need some communications. It also took a while to get there, but we basically came up with IEEE 2030.5 or SEP 2 as the default protocol.

And then Phase 3 are eight additional DER functions which may require compensation by utilities. And we're picking up on that effort again, probably starting in January sometime, to go through both Phase 2 -- but I think we're pretty comfortable there, Greg, don't worry about it -

- but picking up again on the Phase 3 functions, some of which I think could be of interest to the EV world, so we'll get to that.

In addition, one of the important consequences of the Smart Inverter Working Group was triggering the updating of the national or North American Standard, IEEE 1547, that deals with DER interconnection across the country and is very useful in a number of other countries. It's mandatory -- not quite mandatory, but regulators pick up on it, including California.

So just quickly, the Phase 1 functions were supporting anti-islanding ride through of low and high voltage changes. This is really important, so that you just don't trip off because something has gone just slightly wrong. You try to ride through it, both the voltage and frequency. VAR control, where because these smart inverters have inverters, just like EVs have inverters somewhere, you can change the inverter settings through software and extremely cheaply change its power factor, how much reactive power it can produce. And the same is true of EVs. So this, again, could be used -- could be something that EVs could provide to utilities where needed.

We also had some other things like default ramp rates, fixed power factor capability, reconnection by a soft start so that not everybody jumps online at the same time.

As I mentioned, this is now going to be mandatory starting in September 8th of 2017. So the Phase 1 stuff is now ongoing.

Although this is not directly applicable to EVs, because EVs are treated as loads which don't come under Rule 21, per se, one thing that is part of Rule 21 was the agreement that energy storage systems in general which can both generate and charge, that you can do the generation part under Rule 21, and then you sort of jump to Rule 2 for the charging part, which is a little strange but that's the way it had to work. But the point is that EVs can come under that same situation, although they're more charging or, you know, being charged than they are generating, at least at the moment, something like that could be applicable.

Phase 2, probably going to become mandatory soon. I think the key here are two items. One is that all inverter DER systems shall be capable of communications. It didn't mean that all of them were. And we also defined the data exchange requirements. What kinds of data, regardless of protocol, just what kinds of data are you looking for, for particular functions, for particular capabilities? And so we went through and said I don't care what protocol, you could use carrier pigeons if you wanted, but at least what is the data that has to be carried?

Then we got to the things, such as the 2030.5 being the default. That means that California has been able to go ahead and very rapidly put in 2030.5 systems. And the DER manufacturers are putting them in.

We also have the fact that some of this same work is being mapped. For instance, even 2030.5 originally was sort of based on the IEC 61850 information model. Well, that, the 61850 information model is also being mapped to DNP3, which is what utilities use for SCADA Systems. And it also covers cyber security and privacy.

Now here are some of the Phase 3 functions. Some of them are straightforward. And I won't get into the details of them here because I've got another slide that sort of goes into the ones that may be more applicable to EVs. But recognize that these are ones that could provide revenue streams, not clear how yet, that's sort of open. But this kind of effort of sort of resolving this, we sort of stopped because we knew that IEEE 1547 was moving forward. But now we're going to revisit it and see what happens next.

Okay, so it looks like this just jumps to the full model. You saw a piece of this earlier today. It actually should be a build, but it's not building in this. I guess it's not a PowerPoint situation.

Anyway, the point here is that this is a model of

DERs in general, all the green stuff.

The blue stuff is where there are facilities, so it could be a house, it could be a factory, it could be a shopping mall, it could be, you know, anywhere where there might be a fleet.

The upper red part is Level 3 is the third parties. These are aggregators or other third parties that are interested in helping to do some of these complex, sophisticated interactions.

The yellow/orange at the top left and side are, first, at the top is the distribution utility, and then on the side is the transmission utility.

But you can see that there are arrows going all over the place there. And the reason for that is that there is not one set of interactions. There are lots of stakeholders with lots of different requirements, lots of different purposes. And that because of that a single standard absolutely cannot make it. That's not to say that there aren't some good standards that meet specific areas, and that's absolutely true. But what we can't say is that there's one standard, communication standard that's going to meet all of these requirements, including up to the market and so forth.

So the question then is what are going to be the electric vehicle communication requirements? If we look at

it from the same perspective as we did on the Smart Inverter Working Group where we sort of looked at what the functional requirements were, we started with almost a blank slate. We had sort of some ideas, we had some stuff that was going on in Europe, but it was essentially a blank slate. I think we've got more than that now. We've got some use cases. We're going to have to understand more of them.

But I think it's really clear that in order to get the reliability, the interoperability where necessary, and where we should not try to specific something, where we'll let the market forces take over, and I think there's plenty of places where that's the case, well, we'll have to figure out which ones -- where do we want real interoperability were we want to have that plug-and-play, plug it in and away it goes, security, both cyber security, and in the case of the power system security and the market?

So here is a slightly revised or modified drawing. Clearly, you're not going to be able to read everything that's on this slide. So you can take a look at it, you know, when you get back and you've got a big screen in front of you to look at it yourself.

But what I've tried to do is, first of all, here is the electric vehicle down again in the green area. Here's the blue, which is the facility, whatever, it can be a small house, it can be a huge factor, whatever,

commercial, whatever. Again, the aggregators are the third-party entity. The utilities and the market folks up at the top.

But what I've tried to do with these yellow marks is to say these are some of the protocols that may be used in these areas. We don't know yet for some of them whether we would do it one way or another way. So this is one of these things where I've tried to capture at least some of the possibilities for protocols, but I'm wide open to other possibilities. You know, this is just a question -- really trying to set the stage, saying, you know, these are some possibilities, these might be the places that we need to fill in, these might be the places that where we need to continue saying question mark, because we're not going to deal with it.

And the reason I say that, and we've certainly touched on that a lot today, is the fact that there are very different interfaces between different players or systems or devices. They're very different stakeholders who have very different motivations or purposes. And we can't just say, oh, well, we've got one, we're going to do everything through demand charging. Well, that's an important one. You know, find out what the price is, and then you do the electrical charging based on that. But if you have a time-of-use rate or any rate that doesn't change from day to day

or month to month, and it doesn't matter whether you charge in the morning or the evening, or even if it does you're not going to get much out that, so you have to look at it from other ways.

It also is that there are all of these grid services. It's not just energy. It's ancillary services. It's grid support, particularly in emergency situations where electric vehicles could do a lot of good. So we really need to expand the idea that we're not just talking about EVs as a load. It's far more than that. Maybe that's the big one, and that certainly has to be taken into account. But there's a lot more to go on, and I think this is where we need to look at it.

So we have EV to EVSE, obvious. EV to third party, maybe it's an OEM, maybe the third party is some market operator or aggregator or somebody who's going to bid into the transmission market to provide reg-up/reg-down, regulation up/regulation down. It can be somebody that has absolutely nothing to do with a car manufacturer. Then there's the EV driver to a third party that could be a smart phone app. We talked about that also today. Do we want to get into the protocols for that? I don't know. But we might want to get into at least the functionality and then see where we go. So then you have the EVSE to the EVSE to the facility EMS, energy management system, residential, maybe

when you're talking about charging stations, EVSE to a third party, probably the market. Then you have the facility EMS to the third party, and the facility EMS to the utility. And the utility to the third party for grid support. And the utility to the market of grid support.

So you see, there's a whole mesh of different stakeholders who have different purposes, different ideas, different interests. And we can't solve everything, but we can certainly narrow it down and say here's the ones that we feel California needs to define. And in the meantime, we may have developed even more use cases than we have already defined.

Okay, so I think some of these pictures you actually saw a little bit before. But the key here in this particular one is that there are grid challenges from EVs. And so the duck curve is an example, but you also have peak and load differentials that really change what you have to deal with. So that was a German example.

Here I'm getting back to some of the grid codes. And here I will say the grid codes that are -- some of them are in Rule 21. Some of them are these Phase 3 from the Smart Inverter Working Group. Some of them are actually also from the IEEE 1547. And some of them are actually from European grid codes that just came out in April of this year, a little less well defined, but still ones that are

going to trickle down to DERs and -- well, they're for DERs, but they've got a lot of work to do, and could be for EVs, as well.

So we have what I call the coordinated charge/discharge management mode. This is what we've actually been talking about most today, which is the idea that you set the time for when you want it charged. You provide it with information like the prices, and then you let the device, whether it's the car or the charging station or whatever, decide exactly how it's going to do it.

But now I'm going to get into some of the sort of grid support that you probably haven't thought about too much yet. Dynamic volt-watt mode, where the EVSE or the charging station dynamically absorbs in a V1G, or produces in a V2G, additional watts based on the voltage level. Because particularly in the distribution world, utilities are very concerned about the voltage level along their lines. And so, you know, and you have solar systems now at the end of lines. And that produces additional problems of reactive problem and changes the voltage level. So again, this is something that EVs can do.

Frequency watt mode. This is, again, can the EVSE or the charging or, you know, the entire charging station with a bunch of EVs on it or the fleet management system, something like that, can respond to changes in frequency,

again by changing its charging or discharging levels.

Active power limit mode. This, at the moment in DER world, is trying to limit the amount of generation, but the same can hold true for the amount of load. So if it's charging, you might want to say, limit the actual charging at that particular point in time. It just is sort of a limit and you can go up to that limit, maybe as a fleet or something like that.

Okay, I better get going on speed here. Okay.

So there are others. There's peak power limiting. Generation following, following the generators. Volt-watt mode, very important. We did a study in Southern Cal Edison that showed how important the volt-watt mode was, again, something that EVs can do. Volt-VAR control, I mentioned watt-VAR control. Scheduling.

So these are now some of the different views. Again, I certainly am not going to go through these diagrams. But this is the IEC or one of the IEC's visions, because I've seen now a number of them shown today, where they have the smart grid architecture model view of how the different pieces all fit. The idea here is that 61850 will be a part of the picture. That's more of Europe. It could happen here in the U.S.

Another diagram showing similar kinds of things where again you have the different EV stakeholders

and which ones will be doing what.

You saw this earlier today. This is the SAE, in a sense, architecture or structure of documents that show it's going to -- all of these pieces are going to fit together. And I will point out that, indeed, security is a part of it, which is very good.

Again, just some diagrams. Rich showed some of these similar ones this morning, so I won't go over them. But the point is that there are different pieces. Again, there can be a smart meter in the mix, or it could be quite different than that.

Again, I think some of the folks here presented what's happening with these ultra-fast 350-kilowatt charging station in Europe. Pretty darn impressive. We need to be able to take these kinds of changes and expansions into account. And, you know, we need to handle those as much as the Level 1, Level 2, or even Level 3AC-type charging. So I think it's really important to take these new ideas, and not only take them as, you know, they're coming or somewhat here, but what are we going to get in the future? You know, are we going to get 500-kilowatt hour -- you know, kilowatt charger, et cetera? And then we've got a few competing standards there.

Again, I'm bringing up the OCPP, which comes from the Open Charge Alliance, because it is pretty much a de

facto open standard for EV charging, charging to network communications in Europe, Asia and a number of other places. It is in the process, and who knows how long that will take, to go get -- to come -- go through some of the OASIS standard and eventually into the IEC. But the point is it is a standard now that is being used a lot. And nothing wrong with OpenADR but, you know, we would have to, again, take a look at OpenADR in comparison with this effort.

I'll just -- this is fairly straightforward. So these are the communication issues that I think need to be resolved. One of the -- the very first is really to pick or even develop use cases for all the purposes and stakeholders that we really think are valid so we can take a look at them from a market perspective, from a grid code perspective, these are either mandatory or desired, grid reliability, and some cyber security privacy, because privacy is going to be really important in this.

Then we can take a look at the potential protocols for those interactions that we believe should come under the interoperability, let the CPUC-make-a-decision-on level. And for those that we don't -- we say, great, here's some use cases defining some of the stuff, but we're not going to do it from there. And then probably identify default protocols, see where there's some gaps in them, because no protocol yet is quite able to do everything that we've

talked about.

And we should also coordinate across the world. There's no point being -- you know, just saying, well, California, we're going to do it like this. It's very good to start that way. In fact, we have. But we should continue to work closely with the work that's going on in other countries, as well as other states. I kind of somehow think, you know, California is the sixth largest economy. We're almost our own country.

And we should come up with a relatively short schedule for the initial assessment and areas that we know we can move on. So in a sense I'm saying, we should have a phased approach. Let's have a Phase 1 that says, we know pretty much, this is the way to go with this. Now let's take a look and have maybe Phase 2 and maybe a Phase 3 that says, here's some other things and we'll start working on those, once we've sort of agreed on the Phase 1 stuff. But we've got to have flexibility, and I think that's going to be critical.

So that's my presentation.

MR. CRISOSTOMO: So we could take a few questions for Frances.

MR. BOURTON: It's Mike Boulton, Kitu Systems. This is more of a recommendation.

If we're going to set up a workgroup, I would

recommendation that Frances Cleveland, I don't know whether she's available, but having watched what happened in the Smart Inverter Working Group, it's worked very well. It's the best example I can see of getting a diverse group of stakeholders, who initially were the most resistant group I could have thought of, to actually get it. And the final outcome of that is I don't hear any complaints about the result.

So I think it was a very good job, well done job. And if Frances is available, I recommend her for that position.

MR. CRISOSTOMO: Okay. So everyone raise their hand if they're going to have a question for Frances. So one, two, seeing those two, let's keep those to two minutes each so that we can keep going.

Anne, and then Mehdi, is it? I forgot your name. Okay.

So, Anne, go ahead.

MS. SMART: Hi. Anne at ChargePoint.

Noel, I appreciate your answer earlier, but I think I'll ask the question again.

So Phase 3 of the Smart Inverter Working Group, will EVs be a part of it? And does that mean that you are now implementing something that could be conflicting to 15118 and the process?

MS. CLEVELAND: Okay. First of all, at the moment it's a tentative decision to go forward with the Phase 3 review. I think it will move forward but, you know, nothing has been signed.

I am suggesting, and nobody has really yet said, yes, no or indifferent about it, that we include EV folks in that discussion to see which ones, at least of those eight, remember, we're now just talking about those eight, to see which ones might make sense. But I'm not sure that just having the EV folks join that Phase 3 discussion will be quite adequate.

In no way will that undermine 15118 because that's at a completely different level. There's nothing that says 15118 can or cannot do those services.

MS. SMART: Okay. My only other comment to put on the record would be that if we are to develop a working group around this, I think it would be important to look at all possibilities on who would lead that, simply because I think that there is some conflict between some of the goals currently underway in the Smart Inverter Working Group and what would come out of this VGI working group.

And for that reason while, Frances, I'm sure you've been amazing, and I think everyone has said that previously, I would say that there may be some conflicts there that would be inherent to having the same person cover

both.

Thanks.

MR. GANJI: Mehdi Ganji with Willdan.

Thanks for the nice presentation, Frances. A couple of items, before I ask you a question.

What I think, in order to get to State's goals, we need to provide a different public-private environment. We need to provide more application and revenue generation opportunities for EVs, not only talking about the ancillary service provision by EVs and owners of the EVs. We need to talk about that the EVs can be used as a communication node, especially with the presence of smart street lighting these days.

Also, we need to provide the EV owners by micro energy market structure for charging and discharging schedules as needed. Grid controllability is moved towards this internalization and local controllability.

For example, the BMW results showed that the owners are willing to participate into a micro market in order to do charging an discharging.

Also, about the cyber security, I personally believe that the importance of fleets or the cyber security and the communication between the EV, EVSE and utilities is also important. A tracker can easily send a signal to charging -- to the charging signal to all vehicles and

overload the distribution transformers easily and everything out. So that's a main issue.

In that case, I would add the interaction between the utility and EVSE to the slides that you provided, as well, at the end. Well, I can summarize all the applications of EVs into a smart CD's application, especially by the presence of the smart street lighting these days. Thank you.

MS. CLEVELAND: Okay. Yeah, so I basically agree with that. And I think that in moving forward we can deal with any of the issues that might come up with that.

MR. CRISOSTOMO: Okay. Thank you, Frances.

And for everyone who's been commenting throughout the day, so that we can accurately represent your comments and whatever summary we come up with, I will be looking at the transcript. And if you would like to continue to say other things, please do make official comments.

So in the interest of time, is there anyone who needs to hard stop at 4:00? Okay. That's good.

So for this kind of last combined session, I'm hoping in maybe the next 20 or so, 25 minutes, to combine the last three parts around maintaining progress with ideas of how we keep this ball moving forward, and next steps for the agencies and everyone here.

We've been talking about this all day. And you can read this set of potential values beyond VGI, and put that into the context of Frances' systems diagrams. But we continue to need to focus on how we can incentivize private investments.

Previously being at the Utilities Commission, we wholly understand and support what is required by SB 350 to encourage innovation and private investment. And so how do we utilize these values for EV planning, customer simplicity, potential revenue streams, et cetera, et cetera? How do we use that information that we will be collecting and are collecting today to help the value proposition for grid integration.

I'm hoping that these can be some guiding prompts for your comments. And you don't necessarily need to limit your comments to these points, but these will hopefully kind of trigger prompts so that you generate new ideas and help us understand your perspective. So I'll go over them here quickly. We may or may not have time or an appetite for hearing public comments, given the fire drill and the room change.

But how do we accelerate the driver and social/environmental/customer benefits of using electric vehicles to hasten transport to carbonization?

How do markets -- or, do markets appropriately

value investments and higher functions that aren't yet useful or known to customers but might be, quote unquote, "unlocked?"

There are a few examples here around different technologies and different functionalities embedded within the existing slate of design requirements. But recall that smart meters were supposed to do a whole host of things.

But what has actually turned out is not necessarily that full envisioned capability. Nearly immediately after the utilities deployed their smart meters, we determined that we needed a submetering protocol for EVs to get at this exact load.

Everyone knows the VHS versus Betamax story. Frances went over the smart inverters use case. And who knew for autonomous vehicles that we would be seeing these downloadable applications just through, not customer demand, but innovative designs that were foreseeing of what could be in the future. No one was calling for -- no individual driver was calling out for autonomous vehicles immediately. I mean, they could imagine that for decades. But someone finally needed to pull the trigger and essentially force the industry as a whole to start coming up with these new products that we're seeing, again, weekly.

So how do we kind of think about what the future might hold and make decisions amidst that uncertainty?

To that point, how must automotive EV service providers and other actors justify their investments in the marginal technologies to enable those functions?

And how can the state encourage the innovation in these advanced functions to ensure the resilience of our infrastructure, of our cars, et cetera?

Obviously, these are pretty deep questions. We wouldn't be able to adequately capture them in one minute or two minute sound bites at this point. So please do think critically. And although we don't have time here, I highly encourage you to include them in comments into the dockets that will be forming the basis of the agencies' understanding of where you want this to go.

So, Mike, I see you there. Okay.

Just to start closing, and again, we can, depending on people's preferences, hear more public comment, but, what specific concerted and results-oriented implementation steps can the state and stakeholders take to achieve our ZEV goals, our DER goals, our SB 350 goals?

The two next immediate steps that the agencies are taking are, one, working across CEC proceedings. So this lives in the Transportation Docket for the Integrated Resources Planning Requirements that Tim Olson is leading for the POUs. But it is cross-docketed with the Title 20 Energy Data Requirements, just so that we're coordinating

internally. So we need to ensure that our energy data that's collecting in -- being collected in that rulemaking is consistent with what we're doing here.

And then, Mike, you'll come up in a few minutes, but how do we bring research and development and our state's investments in EPIC and the other programs into technology that's validated and ready for widespread deployment?

So just one detail on Title 20. Per AB 802, CEC is developing regulations to better understand charging behaviors which could ultimately inform the demand forecast at even lower levels of spatial resolution and electrical system resolution. So these are two subsections of Title 20 which will be trying to characterize EVs as, one, behind-the-meter loads, and two, understand the operations of networked EV chargers in public and workplace settings.

In order to integrate these two dockets, there was a workshop that was held last month on energy data broadly, not just EVs. The link is here for more information on that. And as I mentioned, this workshop was cross-docketed with that other CEC rulemaking.

Comments are due next week on the 12th. But given that the feedback for this rulemaking, or maybe that's too strong of a word, this effort is due on the 14th. If possible, please coordinate across those two responses. And if you are not directly participating in the energy data

rulemaking, just rest assured that I will be coordinating with other CEC staff on the design of that Title 20 regulation. And if you do have questions, I believe Malachi Weng-Gutierrez's contact information is on this page.

And as I describe this slide, Mike, if you could start coming up?

Our key challenge as the state for the past several years, and this was introduced during a CEC Research Review Workshop last year, was understanding how we can bring the pilots that David mentioned and Adam has been talking about across the utility programs, funded through the DER Program or, say, Power Your Drive at SDG&E, or the CEC's investment in the V2G Project, how do we bring that into the transportation electrification rules that Amy was discussing earlier? And how do we eventually use that as a way of scaling these technologies that ratepayers have invested in?

Mike, if you could talk to these points?

MR. GRAVELY: Okay. Thank you. I'm Mike Gravely from the R&D Division. So in the interest of time, I will make this fairly brief.

One is we have several projects that we are doing right now. I'll mention the Transportation Division is funding projects. R&D Division is funding projects. The Chairman mentioned L.A. Air Force Base. It's the largest

vehicle-to-grid demonstration in the world with the Department of Defense. And some of the challenges they've had, they've been participating in the market since January of this year.

We have a project we're going to be doing with the Marines at Miramar, looking at vehicle-to-grid and microgrids.

We have several projects that were awarded a few years -- a year back. You heard a couple today from some of the presenters, that we're doing different levels of evaluation. We have a solicitation that's being evaluated now. The results will be out in the first of the year. And then we are also developing the third investment plan, which those of you who follow EPIC, we'll be having some public workshops after the first of the year. And there's an opportunity for you to come to those workshops and help us understand the research needs and gaps that we would put in that plan, realizing that plan is a few years away.

So my basic comment here is, one, we do have a workshop on the 12th, on Monday, that we will be covering these research projects. If you have questions on the projects, if you want to learn about the projects, I would encourage you to come there or participate by WebEx. If you don't, if you can't make it, there will be -- the presentation will be available online, and the WebEx

recording will be online after the workshop. But, I mean, there's an opportunity to discuss those there.

For this particular area, though, we have quite a few projects that are doing different levels of research development and protocols and integration. We haven't specified in any of our research projects specific protocols. But we are doing, as you heard, a variety of those protocols.

So for this working group, and if you form a working group, but we would need to know would be what questions can be answer? What data can we provide? What information would you like? Hopefully some of this data is available on projects that are ongoing and we can provide that sooner than later. In some cases the new projects that we're awarding, we can make some moderate modifications to get data that would be useful for this group and this working group that wasn't currently proposed, but we some flexibility.

So I'll just leave it in the sense that we have access to quite a bit of data. We would like to provide that data and be as useful as we can. And we have some, as you've heard, some vendors that are looking specifically at different protocols that we can show the pros and cons that would help the working group finalize their details.

So we'd like, again, I do think I agree with

what's been mentioned here more than once, Commissioner Peterman and Noel, is the fact that we really don't want to wait four or five years to make a decision. So we want to see what we can do currently. And then later on we can do some research to validate or tweak things as we go along.

And with that, I'll take any questions, if there are, real quick on the R&D side. If not, we'll go ahead and move on.

MR. CRISOSTOMO: Any questions for Mike?

MR. GRAVELY: Okay. Thank you very much.

MR. CRISOSTOMO: So as I alluded to before, we need to make sure that R&D is aligned with the need to receive feedback quickly and help the PUC with their electrification plans.

And if, Amy, you want to join me and provide some additional closing thoughts?

Please use content presented-the prompts today, the questions that have been brought up, ideas, everything, as the basis for your responses. This workshop has been docketed in the CEC's efforts, but also has, obviously, been served to R.13-11-007. In response to those comments, Staff will be drafting a workshop report and potentially a white paper for agency review and public comment.

We might propose a plan for this group. And maybe, Amy, you can talk a little bit about that, or

anything.

MS. MESROBIAN: Sure. Yeah. Thanks Noel.

So I think I got feedback from some folks today that a working group might be helpful in moving this issue forward and getting people to be in a room together and actually agree on things and sort of the state of standards. So I would definitely welcome additional feedback, both informally and through the written comment process after the workshop, just on whether you think the working group is a good idea, and any other thoughts you have for moving that forward.

So just to reiterate kind of the idea behind the working group would be to determine which, if any, standards the CPUC and potentially other state agencies should adopt to support VGI. And we would want the workgroup to have a very narrow and well-defined task. Because again, we want this process to be able to feed into our bigger regulatory process. So as we're reviewing utility applications throughout 2017, we would want to be able to take that information from the working group, take the final recommendations and incorporate it back into the record of our proceedings, so that we can issue a decision to the utilities with that information. So we definitely want to focus on a timely results-oriented process, maybe something the in the six to nine-months' time frame.

And then just as far as the makeup of the workgroup, I'm hoping for sort of a neutral third party who doesn't have an interest in the outcome but has some technical expertise and can really lead the group forward and make a kind of significant time commitment over the next year. And then hopefully, you know, all of you, and we can get all of the right stakeholders in the room. So that might mean reaching out to other groups or just understanding who else we need in the room to make all these decisions about, you know, what's our end goal and how are we going to get there, and which standards we might need to adopt to get there.

So, you know, we have a bit of a process and some things to get through. But I think the idea would be kicking off something in the February time frame, you know, funding and support-dependent, and all of that kind of stuff. So, you know, starting in February, maybe biweekly meetings of this working group, continuing for about six to nine months.

So that's sort of our initial thought, and definitely welcome any feedback on that.

MR. CRISOSTOMO: Any initial feedback on that point?

So again, given that we have so much literature and previous work to be building upon, I would echo Amy's

point that the group needs to be defined clearly to not rehash previous findings and conclusions around value, the lack thereof, and grid codes. We don't need to build this from the ground up. And we don't have years, and something needs to change from previous efforts in this space so that we can actually make this relevant to our large-scale electrification.

So any comments before we close?

MR. SOLE: Oh, thanks. Barry again. Porsche. Just my final comments.

Our fears are, sort of from the VW Group, is that if we don't standardize something and everyone is allowed to do what they want, we're never really going to reach mass adoption of electro mobility in the marketplace because there's no true interoperability.

And for us to have this interoperability which allows complete adoption, in other words, the customer wants to know, it doesn't matter which vehicle I buy or it doesn't matter where I charge, how I charge, it's always going to work, in order to reach this level of interoperability, we need standards. And I think, as Steve pointed out, what's not always liked in this area is the philosophy of OSR. And I think we should adopt this --

MR. CRISOSTOMO: I'm sorry. Could you say that again?

MR. SOLE: I like the principle or the philosophy of OSR. It's the standard for ECU (phonetic) software, but it applies to us, as well. Their philosophy is basically collaborate on standards, compete on implementation. And I think that's exactly what we need to do.

We heard the example today about the cell phone. And I half agree with it, mostly because if we look at the core function of the cell phone, it's text messaging and phoning, and that is already basically standardized.

I flew over here yesterday with two cell phones in my pocket from two different manufacturers with two different SIM cards in them, and it worked. Everything was fine because there's defined standards. Of course, on my cell phone I can install different apps later, and these may speak proprietary protocols and allow further functions, and that's fine.

But what we're talking about here is the core function of charging the vehicle, and by extension, integration into the grid. And that's why my message is we need to have this collaborate on standards, compete on implementation.

Thank you.

MR. DAVIS: Steve Davis with KnGRID.

I think I understand your impulse, Amy, in calling for a working group. My biggest concern, though, is that

we're here today because we've had a group of people who have been trying to form consensus for several years now. And the one thing we've heard over and over and over again is from a utility, from a microgrid operator, from the preponderance of the EV manufacturers, not everybody, but even some of the ones, one of the ones that was on the alternative side said that they plan to implement ISO 15118.

So we have as good a consensus as you're going to get. A working group won't, in my humble opinion, having been at this for several years now, that's unlikely to change. I just want that out there.

I would tend to echo, in spite of Frances' outstanding results in the Smart Inverter Working Group, I would echo some concern that a working group that went down a certain direction, that somebody might already have or she might have some preferences going into it. No disrespect at all.

But I think we do absolutely, if there is going to be a group that's taking a look at this once again, and remember, this is has been going on for years now, that person has to be completely neutral, and we can -- and I would even argue against doing that, but that's predictable from my side. I think there's a preponderance of evidence that we have a global standard. I think it's ready to go, I think we've heard that and I think that it's -- we're at a

point where we should move towards implementation and not waste another year, if we're honest, with analysis paralysis, and I think that's where that's going to lead us.

So anyway, thank you.

MS. MESROBIAN: Yeah. So, I guess, one comment and maybe question for you or others is at the CPUC, we make all of our decisions based on evidence in the record. And we currently don't have enough evidence in our record to make a decision. So the working group was designed as a pathway to get that evidence into our record so that, you know, the judge and the Commissioner could make that decision.

So if it's not the working group, then it's our regulatory process, which might be longer. So that's sort of the tradeoff and why we were thinking of that idea.

MR. CRISOSTOMO: While Abigail is walking up, let's un-mute the phone from Dan Bowermaster, and then Rajit Gadh from UCLA, in that sequence.

Please Thanh -- Dan?

MR. BARROWMASTER: Hi. Can everybody hear me?

MR. CRISOSTOMO: Yes, we can. Thank you.

MR. BARROWMASTER: Yeah. So thanks everyone. So basically, I'll be blunt. EPRI is in full support of the working group. And we're happy to help or host as the broader stakeholder community deems appropriate.

Thank you.

MR. CRISOSTOMO: And Rajit, please?

MR. GADH: Can you hear me?

MR. CRISOSTOMO: Yes, we can.

MR. GADH: Yes, we can.

MR. CRISOSTOMO: Yes, we can.

MR. GADH: I have a couple of points since that question.

And the first was a question to Mike Gravely specifically. I think that CEC is gathering a lot of data and it's very exciting. I think that if we can somehow, the community can get that data, maybe through some standard interfaces or something like that, then I think we can all benefit and do our research and analysis. So that was just a thought I had.

I don't know if Mike is still there.

MR. CRISOSTOMO: Mike, can you answer how -- could you answer how, with the EPIC projects that have been worked on thus far, is there a way to share data, and is data publishable?

As he's walking up, I'll offer one point, Rajit.

MR. GADH: Sure.

MR. CRISOSTOMO: Tiny.CC/EV Reports was a project of our former intern, Adam Orford, who was presenting this thing last year at the research review. And that is a

compendium of the projects that were at least in progress.

So, Mike?

MR. GRAVELY: Oh, so two elements.

One, I think in the workshop on the 12th, we can bring this up and develop an action item to share as much as possible. But I will also caution people that in many cases the data we're collecting is considered confidential or individual or private and not always public, so we have to find ways to do that. So just because we have data doesn't mean we can share it openly amongst everything because of the rules we have about individual customer's utility data.

But I think given this workshop in this area, I think on the 12th, and then any other time you can do it, through your comments here or with us direct, if there's a way we can get together and do this, the purpose for this workshop we have on the 12th is to share all these projects and bring everybody together, and we will do that. So we just need to agree, I think.

So one action item we'll take from this meeting to bring into the 12th is to see if we can come up with a way to do that and determine what data is available for sharing, and other information that can be aggregated to help, but we're more than willing to do that, and we're more than willing to, as we go forward in the other contracts, we can make it more significant. And it will be voluntary for the

people that are working now, but it may be mandatory for people in the future.

MR. GADH: And can I make a second comment?

MR. CRISOSTOMO: Sure.

MR. GADH: Quick point.

MR. CRISOSTOMO: Very briefly, because we do have Abigail.

MR. GADH: Briefly.

Okay, 15118, I was very excited to see the discussion today. I think that there's a lot of investment in sort of the current 1772 installation, Level 2 and Level 1 chargers. And I think that's what it -- because we don't have the SOC, I think that moving in that direction is great.

I think then, in addition to that, however, I think that we should be open to methods to have even more creative approaches before the interface between the vehicle and the charging technology. And I think that there's a lot of interesting innovation coming out of labs like ours that, you know, I think that 15118 is great, but I think that we could do more than that.

MR. CRISOSTOMO: Abigail?

MS. TINKER: Abigail Tinker, PG&E.

And I would like to say, in support of Amy's question, that the Commission needs the record to make a

decision of which, if any, standards the CPUC should adopt, and that sort of assumes that you should adopt a standard.

And we support the concept of the working group, particular after observing today that there's -- we've heard a lot about different VGI value stream, potential value streams, and also different potential communication pathways and communication standards that could access those value streams, and that any -- that this working group could provide an opportunity to set out what the criteria are, and then make a choice based on those criteria, that record that would allow you to show, why are we going in a certain direction, not just jump right in and go in a certain direction.

MR. CRISOSTOMO: Other commenters?

Urvi?

MS. NAGRANI: Urvi Nagrani, Motive Power Systems.

One of the notes that you had up earlier on your points for discussion, which I think is kind of important to come back to, which is how do we accelerate the driver and social general customer benefits of using EVs to hasten transportation and electricity decarbonization, which is a mouthful.

Realistically, we are in the state of California at a time when the U.S. is going through massive changes. And we have to acknowledge the fact that politics plays a

role in everything. The last two years, when we did not have the concern of having a federal government going in a different direction that the state government, we were still unable to pass the GGRF funding portions of the budget to actually support any of the plans that we claim to support in a timely manner.

Now I imagine that's going to get radically harder as the state has already indicated multiple concerns with the incoming president-elect's plans. And so any plan about investing that does not include a solution that doesn't just benefit the industry and doesn't just benefit regulators and utilities, but society at large in a way that people see in their daily life, is likely to be a political non-starter. The budgets are likely to be delayed. And if the budgets are delayed, then we might as well say we won't have a plan or funding for another nine months, making it impossible for small businesses to participate. So you're only going to have the OEMs and utilities that have been participating and dragging their feet for the last decade. That is obviously not an optimal scenario.

So we need to think about if we are crafting a solution, how do we include everybody in the viability of that solution and extend it to all parts of our states, including disadvantaged communities, minority groups, and also rural areas outside of urban hubs where income is

slightly higher. I think all of that is going to revolve around thinking about both fleets and private vehicles. And we need to have an in-depth discussion on how these programs fit into a broader, integrated approach in order to find an effective solution.

So if your working group is purely technical, I don't think we will find the solutions we need.

MR. CRISOSTOMO: To that point, if we are uncertain the best structure of a group of not, maybe in comments, add to this list of four.

What are indicators of success that, by the -- and I'm speaking off the cuff, not the official position or the PUC or the CEC, but what are the indicators of success by the end of 2017 that would suggest that we, as a state, are on the path toward grid-integrated infrastructure by 2020?

Again, I keep returning back to the slide of not having a ton of time. So how do we structure the next several months in the most effective way possible to actually achieve our goals?

I've heard both sides say that the other is an impediment to achieving goals. And there is truth somewhere in those ranges of options.

And so how do we find the path forward, given the market challenges, and potential failures that we've seen, to resolve these types of questions in the way that we've

previously gone about solving the question -- solving the problem?

This is your industry and your answers. So again, welcome any comments verbally or through --

MR. DAVIS: I am not an OEM, but I do know several of them and I talk to them a lot. Their planning horizons are quite long. And every day they don't know what to make extends the data that we're delivering large quantities of these vehicles out by that much longer. So we are -- the time truly is of the essence if we want rapid adoption of these vehicles and by a simplified refueling experience.

I understand the impulse for getting more data into the record so that the Utilities Commission has what it needs. But I would also say, there is an absolute mountain of data of existing studies that have been done on grid integration using the various approaches. So, I mean, we don't want for data. We don't want to long-term investments in reports that have already been done for us. They're there for anybody to explore.

So again, I understand that it sounds good, it sounds so reasonable to say let's do another working group, but I caution that. The same, you know, polarity you saw on display today will be there waiting for us in any working group.

So at the end of it, somebody's going to be

frustrated and disappointed, there's no question about that. But the state has to send that signal. It has to do it soon. And that's what we've been advocating for four years now. And so that's why I guess I bristle a little when you see me, when I hear the suggestion of, okay, let's form a committee, let's start this again, because these conversations have been had. They may not have been had by everybody in this room, but they've been had. So that's -- the people that will arrive in any working group will be the same people that have been unable to move past this polarity.

And you even saw, again I would say this, in the OVGIP Group, you had two sides of that. There's division, even within that camp.

So again, I think you did see an awful lot of people stacked up behind ISO 15118. I did not see as much stacked up behind the alternative approaches.

The other thing I would say is that nobody is suggesting that the OEMs be compelled at this point. The point of regulation, let's remember, is the charging station investments. There is no cost differential in those charging station investments. You can get 15118 or non-15118 for about, we're talking network stations here, about the same price.

So that's why you hear me arguing, as I am. I

hope that doesn't sound unreasonable but that's my perspective, which is what we're trying to get, is perspectives.

Thank you.

MR. CRISOSTOMO: Thank you, Steve. That is a legitimate point, because we have had this conversation, as noted, footnoted in Appendix B, for literally years. So we do need to act in some fashion. And we seek your feedback on how to do that.

Adam?

MR. LANGTON: So, yeah, I'll be really quick.

What I've tried to reiterate a couple times is that we don't think, at least I'll speak for BMW, we don't think that selecting a single standard is the impediment in this space. If you want to move quickly there are existing communication options that we can use now to move quickly.

If you want to use 15118 and you go down that path, what you've got to consider is that there are very few vehicles right now that have 15118, and there are no charging stations right now that have it. So we would be several years away from being able to use it, if that was the exclusive standard that we chose to use.

I think what we've seen here is actually that there's a lot of -- there were several times where people had to ask what a different acronym meant and what the

meaning of different terms meant. So it's clear that there's not a common technical understanding. And if there's not a clear technical understanding, then we're not prepared to make regulatory decisions related to the standards.

Thank you.

MS. DELEON: Hi. This is Nikki from EVgo again.

And going to one of the comments that was made earlier, I think it's absolutely correct that we need to think about what's happening in underrepresented communities, and who are those stakeholders who aren't here today.

And going back to one of the slides that Noel showed earlier in the day, there was a circle that looked at the utilities, the EVSPs, and also the OEM manufacturers. And who's in the middle? The drivers. The drivers are not here today.

And so what can we do to figure out the driver for those drivers and evidence of those driver actually capitalizing on that value?

So I think that is going to be a really interesting outcome that we could be specifically measuring, too, for understanding the value for the driver and the PEV, and a pathway for those specific dollars to be getting to them to reduce the cost of ownership.

MR. CRISOSTOMO: Thanks.

Craig?

MR. RODINE: Hi. Craig Rodine, ChargePoint.

I think it's important to recognize that the rolling stock out there does have, if it's using DC fast charging, and that's from U.S. and overseas automakers, with the exception of those that support CHAdeMo, but they all run a version of 15118.

And if, you know, GM, in its Volt which supports that, reaches the kind of volumes that you hope a 200-mile range, $30,000-odd after federal tax credit vehicle will reach, which we hope it will, and it's similar to, you know, another model that's coming out, we will have a growth in that standard. There are -- we are pretty confident that OEMs can upgrade their -- as long as they've planned for it, and that's TBD, but at least for the DC fast charging, they can upgrade that to 15118. And that gives you a little more traction than I'm hearing represented, as though there are no cars out here now.

Thank you.

MR. CRISOSTOMO: Steve?

And let's close, since it looks like there's less chomping at the bit.

MR. DAVIS: Yeah. I think that, you know, I understand Adam's statement that he doesn't believe that a

common, unique standard is the impediment to doing VGI because he can do certain use cases with telematics. But that doesn't help Volkswagen Group or Daimler or several other OEMs that I know who have plans to implement the standard. Yes, there are no 15118 vehicles -- there's a few, but there are very few of them out there to date because this is a chicken-egg problem. You're not going to get that unless you lay the foundation, lay the keel, if you will, with this common, unique standard.

And we need to be thinking about skating, not to where the puck is but where the puck is going to be. And that's going to be more autonomous fleets that are out there. And the fleet operators may want to have that fuel included in the service. And that means that that vehicle needs to be able to pay for itself. And that means you need seamless roaming and plug-and-charge.

So again, these use cases we're contemplating today, they're going to be evolving very, very fast. And we do need a flexible standard for this association.

And again, coming back to one of the things we want in our vision is dispatchability and resource certification. That means meter association. And you're not going to get that wirelessly. You're going to need to have a hard wire that makes that vehicle associate with the meter on the charging station which is contained in that

standard. So now you've got revenue-grade metering and the battery together as a DER.

So that's how you get resource certification. And I think that helps our folks over there at CAISO as they map out how they're going to be aggregating and dispatching these vehicles through third parties.

Thank you.

MR. CRISOSTOMO: Okay. And last question from Stacy Reineccius at Power Tree.

Thanh, if you could un-mute him?

And, Stacy, go ahead.

MR. REINECCIUS: Thank you. You know, a lot of this, as the last several commenters have highlighted, it about how do we make sure that we get more vehicles on the road so that we reach the critical mass necessary to make many of these activities cost effective to operate.

And I want to come back to, actually, the slide that you're showing, and then another observation. Go back. That one right there.

If you look in the lower left where you say site host, you are missing two huge aspects that the site host provides. They not only control access to the parking, they provide the actual electrical infrastructure, and they pay for it. And that can't be forgotten in any of the programs the state is trying to undertake.

As we know and have filed recently with PUC, many of the multifamily/multi-tenant properties have been significantly underbuilt. So one, if you want to accelerate deployment to the 42 percent of Californians and the majority of the people who live in the major EV markets, you've to put into place at the state level programs that accelerate deployments into multi-tenant and multifamily products. And you've got to remove the barriers in time by putting some prioritization, maybe a declaration of state of emergency by the governor could be assisting to doing that, to move the utilities to move faster on upgrades and installation work necessary to support EVs.

Right now we have the state declaring several clean air policies as critical policies. But when it comes down to the nuts and bolts and putting this into place, it is delayed by the guy building a standard product.

So it is very important that this be a coordinated effort, and that when you think about the doubling or the tripling of the size of the market that can be achieved by bringing all of the renters and all of the folks how live in multi-tenant properties into the market, that's perhaps the single most effective thing that we could be doing to enlarge this market and impact GHGs, which are the goals.

Thank you.

MR. CRISOSTOMO: So seeing that there aren't any

other hands about to be raised, let's close the day.

I think that's a joke, Urvi.

I really want to thank my colleagues at the agencies and CEC for wrangling this together on short notice and in a coordinated fashion. We're doing this so that we can help the industry out and achieve our state goals. So let's find a way to work together quickly. And please send comments to those points by next week.

Thank you. And I think all of these presentations are docketed and online now. Thank you.

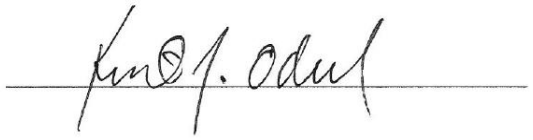
(The workshop concluded at 4:05 p.m.)

REPORTER'S CERTIFICATE

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 28th day of December, 2016.



Kent Odell
CER**00548

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.

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.

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 28, 2016