

**EPIC POLICY+INNOVATION COORDINATION GROUP**  
**TRANSPORTATION ELECTRIFICATION WORKSTREAM – MEETING #3**  
**NOVEMBER 19, 2020 2:00 PM – 3:30 PM**

This is the final meeting for the Transportation Electrification workstream to gain customer participation in vehicle grid integration efforts and planning an implementation of charging infrastructure development deployment to avoid distribution systems impacts. They we will focus on the customer side of the equation. What we have learned when customers enroll in green interactive ministries. Based on what we know about customer needs and. I thank you for joining us and participating. We will have some other panelist that will join us for a Q&A at the end. We will have some introductory remarks from Ed Pike from the California Public Utilities Commission pair will also here for Gustavo Vianna Cezar, SLAC National Accelerator Laboratory. We will hear from Doug Black, Lawrence Berkeley National Laboratory and JR dish azo from UCLA. That number seven should say group discussion. And we will have discussions on these topics and look at the key learning that we've gathered through these three meetings. Today the presenters will be asked to share insights and lessons learned from their projects and related work in the following areas. What are the insights and lessons learned we can go to gain informal marketing education and outreach efforts to enable customer engagement around vehicle grid integration. This is a working group recommendation 9.03. Also, what can be done to better plan and optimize charging infrastructure deployment to avoid distribution system impacts? And as always will have a discussion of the opportunities for coordination of collaboration among transportation electrification RD and D efforts. For a few technical notes for the conversation our presenters. Will be keeping the presentation short on topics of. If you have a question or for any of the presenters, please include that question in the Q&A box. On the right-hand side of the screen. You may have to click a Q&A button on the right-hand side. If you cannot see it, they might be behind three dots in the lower right-hand corner. If you have room troubles reach out to Amanda for Nelly. Or send a direct chat to her. As we go through this please remember the meeting will be recorded and we also have a live transcription and live in Spanish translation for the discussion here. You can see the link at the bottom of the screen to actions that picked I want to start today welcoming everybody and I will hand the mic over to Edward Pike and he will give a little bit more context on the insights we will begin today. >> Thank you everyone for participating I just want to give brief context to some of the recommendations that have come to us on this topic pick and a couple of topics will be covered today pair has this is a report that came out in June earlier this year where there were no stakeholders provided recommendations of one of the recommendations is. It received the whole closest to the highest levels of agreement pair has you can see here it was actually strongly supported specifically to and that is very important topic for instance figure out customer engagement around vehicle grid integration use cases pair has a lot of them aren't well-established. This probably has a lot of lessons to be learned. I appreciate everyone participating today because I think it is going to take everyone to get to these answers. The commission recently released a decision which I have put in the chat box a link in section 5.8 it acknowledges the importance of ME and O as recommended by the vehicle workgroups. It also differs any specific action by the commission on future decisions on the transportation electrification framework. The commission has in the past addressed specific applications that are coming from utilities, so it is not a blank slate. There has been some history where the commission has

approved efforts in some cases and I will also mention a couple of their topics that you could find in the proposed decision. Related to some of our conversations today. There are some said discussions about distribution impacts in section six, there are other discussions about policy actions and vehicle grid integrations. If you haven't had a chance take a look at that proposed decision. You can just stop by the table of contents so that you can see what the commission has proposed. That could change the Senate Bill 676 we are required to issue a decision by the end of this year. So that is it for me.

>> Thank you I am not able to make it larger I know this is a very small slide. I tried to find a way to zoom in, but it was not successful. We will provide a link to this information in the chat pick could you explain the acronym MEMO.

>> Yes, marketing education and outreach. To walk foe's through this graph on the screen 6.03 was a stakeholder recommendation. Supporting ME and O you can see five is the best score and you can see that it is one of those highly supportive recommendations. From the vehicle grid integration working group. That is the point of the graphic here. With 9.06 is in the red box.

>> Thank you, Ed., I appreciate this pair has I want to move onto our presentations for today and hopefully as we walked through the presentations and we walked through the group discussions afterward that we keep in mind a little bit of the context around the revelatory work that is ongoing. And what information that we still need to solve for the future. So, I will kick it over to Gustavo Vianna Cezar, SLAC National Accelerator Laboratory to walk to epic projects that they work on. Gustavo welcome.

>> Hello everyone, hello I am Gustavo Vianna Cezar, SLAC National Accelerator Laboratory. Decisions that we made along the way inside the project partners for E3 chart points. So, this is just a note a general outline in reference. Yes, so this is the main goals of the project is to develop a product star charging framework for EV's that consider future travel plans of drivers and various power systems. So, this is again high-level framework this is three main graphs data analytics and interface. We will talk about each of them in the coming slides. So, there is data that we utilize this is the large depot charging data that we use. This is why we chose primarily some of these data sets. The key of relevant takeaways from this graph is that there is a large number of data sets. So, this primarily has to do with our data set is specifically in one charging station. So most likely they have access to charging stations. So even with this large data there is to opportunities the challenges on integrating different data sets into the process is a problem on its own. So, the next I please. So here is the smart charging we will start with the data and a little bit of explanation on it. Starting with smart charges data-driven method to model charging control drastically reduce competition at time. Learn a mapping function  $F$  that given an uncontrollable profile generates a controllable one given in objective. Benefits of proposed approach is speed elimination of controlled EV load and scalability to millions of vehicles. So, we show some of the remote approaches with this approach the rate structure, also the point is this can be utilized by other states and. This next slide is a statistical modeling framework for EV load profile generation, it shows multiple imports that can be changed ugh aggregation level, and number of TVs. Changing segment percentage and battery capacity, control and data type. So. And the benefits of the proposed approach are models can be stored and shared without individual driver information and scenarios can be generated targeting particular cases e.g.

predominance of charging segments. At the bottom would show the forecast of the scenarios which assumes charging habits at work and at residential areas. This scenario is called the work scenario. So, the next one is cost-benefit analysis. And so, we have different forms this analysis for different perspectives such as EV owners' ratepayers in the region the reason why we analyze this pair has so we analyze the costs and benefits from different stakeholder perspectives and we also compare results for smart charging versus on them and manage charging scenarios to see the value of smart charging. So, we are looking from the EV owner's perspective and how it equates to that. That is how the assessment performs. Our next slide is project results and insights. It is a base case high adoption low adoption and equity scenarios all rely heavily on residential segment to meet the needs of growing EV adoption. Fast public scenario presents a good trade-off between residential and nonresidential charging for the day. And also work scenario significantly increases the EV load during the middle of the day which is beneficial to confront solar gin solar over generation. EV load management and coordination is simpler to implement. So, this slide shows prose or project results and insights. A few of the key takeaways here is each case as hi adoption and low adoption. To meet the needs of the EV adoption the scenarios basically present a good trade-off through charging throughout the day. The work scenario significantly increases the UV load during the day the solar generation at the time. In particular this at work smart charging is relatively simple to implement and practice compared to other segments. Project results and insights from a cost-benefit benefit analysis. Assessment included societal ratepayer and EV driver perspectives TRC state as a whole in each county benefit overall from EV charging indicating that policymakers should continue efforts to spur EV adoption. Are I am all utility ratepayers who do not have EV's may still benefit from broad EV adoption. This likely increases the benefit from their choice to adopt EV with lower lifetime costs compared to conventional vehicles. Differences and benefits using smart charging compared to not using it are minimal for all stakeholders' perspectives. Takeaways and lessons. Flexibility in generating EV future demand across different charging segments can help inform utilities where to target. It helps to understand where if charging what happened in more section or the other. Workplace charging is better suited for smart charging than other segments, large EV charging data sets are not widely available to reach community. If Charlie Ching -- of charging continues to be Donnelly happened in the residential sector major upgrades and infrastructure will need to happen at different levels which may include both medium and low voltage systems Transformers lines and residential panels. Lack of communication standards and data schemes makes it difficult to obtain complete visibility of the system. There are two approaches for projects one is can get data from the EV installs in the other from the charging stations themselves. So, they are complementary to each other. There is no easy way to map one to another. The mobility of the is also a key to understand the full picture of this. Not only on the EV and data side it is lacking in community but survey the captured data for new policies and investments and so on. The last point I want to make is to another grid service. They are participating in different services and might be completing objectives. I think these are all questions need to figure out how to answer in the EV adoption in the future. I can take questions.

>> I just want to give it a heads up I think there are several questions. Related to the workplace charging. Woman get to the Q&A we dedicate a portion to discussing that. The technical, the vocation is at the behavioral side and I will give you a heads up and will talk about all those more. Want to make sure we cover some time to the data sets not being available to the research community and some insights onto what that means and how can we gain access to them. I think

that is something that is consistent. I appreciate that cassava. Next, we will go to Doug Black, Lawrence Berkeley National Laboratory. To talk about the smart charging and engagement. Thank you for joining us.

>> Hello thanks for having me. I have a little bit of breakup listening to Gustavo. If it is let me know. I am making do with an impromptu spot here. So, I lead of the integration group. At the Berkeley Lab as the name implies we focus on control, management and cybersecurity of distributed energy real forces -- resources. Pucelle's CHP's microgrid configurations and distributed management. So, what we do talk about today is one of which we had a specific problem to solve. For Alameda County. And nice all in one location with fleet charging workplace charging, and a D.C. fast charger. They were making great efforts in converting their fleet to electric vehicles and offering electric vehicle charging to encourage adoption by the workplace and the public. They were on a standard commercial tariff with a demand charge. Our objective here was primarily caused and come up with an automated smart charging system. To lower costs but where will it really what we are doing is connecting the network to shape EV charging loads. The cost is really a driver for reasons people use or not use it. The peak demand now is moving into the evening hours, but this approach works for all of these times if you want to charge during the day if you want to use PV on-site or move around to different demand. The focus was on that afternoon demand pair has two was a small startup that started with integration using the technology that was here. So, to get some insight here. You can see the parking structure in the basement of the structure is Alameda County's fleet operations center. It has chargers, and, on the outside, they have accessible at all hours you have a D.C. fast charger. On two levels of the parking structure they had charging stations for employees and the public and it shows a fleet of TVs that they have. To illustrate the what they had for the increased demand charges. The chart on the left shows before EV charging their load at the parking structure. The plot on the right shows after they implemented the EV charger morning peak is from bro placed charging in the left in the late afternoon is from the vehicles returning to charge. The bottom shows workplace charging with pretty good consistency from start time and the amount of charge taken. The dark portion of the bar is after it occurred to light part of the bar is where the vehicles connected to a charging station but were not charging. This gives us an idea of variability that you need interface with the drivers. So, to do that we came up with an atypical app. This was text based where we detected the user ID of the participant when they connected to the charge station and we sent them with the text to collect their departure time how much charge they would want answer at that. So, with the goal being in the main plot there, showing the blue line is on managed charging each of those purple bars with the dockable rectangle and squares are individual charging sessions. Each of those charging sessions is broken up and how they deliver the same amount of charge but reduce the aggregate charging load to the flatter greenline. And here is the public charging station the examples in the top two slides, the red dashed line is charging that was re-created if we had not managed to load and we receive the full charge rate and the blue line represents how we were able to fix that and decrease the peak load. The figure in the lower left is the blue line is the load and the Graybar show spikes on the fast charger. A D.C. fast charging session shows up and it is significant demand settings and cost. The red bar shows a D.C. fast charging session but one in which one we saw that session we throttled back the fleet charging stations. We were able to decrease that D.C. fast charging and an easy way. The bottom right is really where the results of the overall's project is shown. It shows the blue line is normalized facility of electricity costs. At the Orange line shows the charging energy that

was delivered to vehicles charging. As charging energy increase the more charge that was delivered to vehicles by being able to keep the demand charge low and minimize the setting new peaks were able to keep the costs the same while providing increased charge. So are lessons here being one technically not particularly difficult human behavior as usual was a challenge. The communication standards on which programs a station might be in an issue this is an application for a particular configuration. With good charging station APIs, it did not require communication all the way to the vehicle, but it did require communication to the driver. And next medication to the driver is where the human behavior part comes in and is a challenge. We had a hard time with retention even though we were using drawings for the number of sessions that she responded to with your information. It gave you an extra an entry for an Amazon gift card. It is hard to manage the amount of money the money per individual driver can be can be a compelling enough, so it gave us a little gaming and low-cost gaming. It came under the costs that were saved with the management it took a lot of. It did get into the operation logistics while looking at much more regimented and easier to track public or workplace charging is not necessarily always the case. Especially with in this case there were more EV's then there were ports. So, juggling around those vehicles made the predictability one interconnected one will be charged, a little more difficult. Fast charging has to be used wisely so as not to set a costly maximum demand in P. We had a good way to do that in the late afternoon and evening hours. To be able to throttle those back when a fast charging session was happening. If you didn't have that you may want to look at additional reporting in fixed battery storage all controlling other loads that might be high behind that same meter. That does it for me.

>> Thank you Doug I'll leave your contact information up on the screen so that folks have a chance have to write it down. So, forget also put it in the chat that will be helpful. Gustavo if you have the e-mail address and contact information you can put that the checkboxes while. Thank you Doug I appreciate it, I think you had some interesting reports there about retention. And how you know it is interesting in the beginning but over time. I think when you get to the Q&A there be some interesting submissions there. As we go to the next beep poker, who might also have some insights to share on the topic of as well we will have JR dish azo. We want to hear some insights from additional areas and customer engagement and might be able to share some lessons as we go into the customer acquisition and retention and valuation but also you have a lot of thoughts here on vehicles as well. JR welcome it's nice to have reappeared

>> Thank you I've really enjoyed your presentations. I am going to start out by talking about a residential customer demand response undertaken by two different cost pennies, but I am going to feature on connect. Then I'm going to offer just some remarks based on my own work on charging behavior. So, one of the epic funded studies that we did was to look at the extent where you could recruit residential customers to reduce the energy consumption. Will be notified in advance usually the day before. That they're going to experience at critical peak our home our from different things in different companies. The important thing to do is to build awareness and attend patient of the event. Usually by text message. What it did game five participation in the process. Participating customers earn points and they could use those points for material benefits. The primary strategy was to reward sustained.

>> I think we lost you. There you are

>> The game of vacation strategy was to not only make it fun and reward you for progress but to give you larger benefits from Morton sustained incremental progress that you remain. The longer your streak and larger your energy read Dutch and the Lodge of the multipliers were on the benefits and the points that you received. So, you kind of amplify the marginal benefit so the participation and for the reduction with the lease for sexual response to him which you reduce your demand. I have to say that compared to a lot of the programs that we looked at the on connect program is very successful. Materially and statistically significant it produced annual responses in customers that lasted several months. One of the things we noticed is that the relatively small rewards that the households received from participation gradually lost their power to sustain cooperative behavior over time. There is this kind of attrition that happened, and I will say we did a lot of work to understand different customer types in another parallel study. There are some diehard statistics but if you're looking for that little part of the market that you can move around. The bottom line is this game vacation that we've seen in other settings, we seen our kids enjoy games they kind of lose interest. Over certain period of time. The financial rewards were very modest. One of the things we concluded is that they did a great job they were cost-effective relative to the resources they were providing. Because with a lot of information primarily, but that automation was going to be a more superior strategy where you didn't have to rely on cooperative behavior. At least in a continuous fashion. So, I'm happy to answer questions about this we can talk about more.

>> We lost you again.

>> Okay that's fine I unmuted myself that time. I want to talk about light duty passenger behavior. I think the behavioral challenges of connecting vehicles to the grid car are much greater than any of the technological effect challenges that we face now. I would start with the fact that most vehicles don't connect. The vast majority don't connect during the day. The only cadet connects residentially. The workplace charging is the most promising opportunity because the opportunity cost of the delaying charge is zero. So, you can shift the charging into the future with lower cost. But the longer-range vehicles are reducing the put density to connect by new vehicles because they don't need that charge. One of the things that we haven't studied very effectively is parking behavior. In the opportunity cost of parking at different locations. And with the time because of those trade-offs are. I say that because the time cause and delaying charging and parking in one location v versus another are nontrivial relative to the customers cost of electricity. The average EV driver spends about 50 bucks a month. Even if you gave them a benefit of a 10% increase you're still looking at the price of a Starbucks coffee. In terms of compensation. To get them to walk to exit three blocks 20 days a month to get them to park in a place you want them to park and you have to really think about the connectivity. I say that for life duty fasteners. -- light duty passengers. Some of the work I have done suggests some drivers are responding to EV rates. And they are shifting their connectivity and their charging behavior. One of my strong suggestions is to do analysis actual experiments around the EV used trades. We will also use smart charging analysis and found that pic for buses the opportunity cost of charging during the day can be on the transit system, was relatively low. So, the opportunities for using buses which of course have larger batteries and they can provide that battery capacity to the grid are large amount services are going to be significant. I would do this towards the bus leads as opposed to light passengers at the moment. On the behavioral side is not just the drivers I think a lot of us in the zoom conversation here appreciate it is very hard for vehicle charging

stations to make a profit. It is very difficult to find a business model that makes them viable. I think that is a collective problem that we all focus on. The reason I mention that is because that is making EV stations more prevalent in market supply is part of the solution that increases the opportunity for connectivity. For vehicles that otherwise are going to need to be connected we are trying to improve convenience and reduce the cost of using them for some of these two connect. I will stop at that.

>> Thank you, JR acronym check.

>> Transportation network companies that is over and lift. T and C.

>> I think we had good presentations there. Let me get back to the screen. WebEx's told me we've had a pretty good a tentative list to the meeting. I want to thank you all prefer presenting we are going to move now to our queue into eight sessions and we do have several questions that are started to come in. I want to welcome in some other folks were going to join us. You are free to turn on your video and join the discussion. He is. Welcome Stephen. And Ed looks like were still there. I want to throw some questions that I've kind of previewed after discovers presentation. Around data. And maybe we start there. Obviously, all of your projects analyze actual charging behavior. And look at the success of impacts being able to shift some of that load. How much data is out there what daters really needed to understand I think we are from the last presenter here. The key to understanding what the impact is in the sustainability is not just where in overtime who and what functions are providing that infrastructure. What daters out there what daters needed to help us understand where we need to go here? I will throw the question out first anybody to jump in.

>> I think we have had a really large data set on just on the EV charting. There was a lot of information there was missing because we do have access to other charging stations. The biggest hurdle is sharing private information and that's why went to the CERT models. We are not we can share that model with the research committee, so we can get the same resource. And then there is no problem with sharing that information. But I think going back to the other presentations the customer behavior side of things is what I think the biggest data that we don't have. So that we drive strategies if you're trying to smart charging and all sort of things. So maybe is not how much data is but what happened between all the data points. Whether charging from the beat vehicles itself call location from personal behavior in all the segments.

>> Are we looking at gaps here? -- we are looking at gaps here Stephen what kind of data do we need.

>> So, our work here at Berkeley, we looked at a subset of EV owners to understand their charging programs. It was like 34 people we really don't have that cap preference data set necessarily how consumer reacting to two programs. We were able to do a preference survey to understand why people like smart charging programs. That is the same as getting the preferences you can idealize something in the system but over time people fall off and we have that attrition rate. I think we need both an SP and an RP plan to data.

>> On the engineering side of technology development, we spend millions of dollars on test goods. The equivalent of a tall policy testbed is a policy experiment. Where we change prices in the costs and the rewards of drivers received. We look at their behavior. Where now at a point on the grid where we really need to manage behavior. And we are not using the social science tubes available to us.

>> I want to remind everybody that we do have some great kosher questions coming in in the Q&A function. Please pose them there. If you are part of the panelist section here if you like to pose a question turn your video on and I will go on and ask your question in person. Or the chat either way. So, we start going through the Q&A here this first one, comes from to what extent is the conclusion or charging considered business or behavioral aspects or is it from a technical aspect.?

>> looking for me too technical perspective you are just in one charging station. If you would do and control from the starting dish. [ Indiscernible by captioner ] we have a few projects with big technical things in the bay area, so we have different strategies in between them. One is we enforce people to remove the vehicle once they are charged. Because they don't do this because they cannot find parking everywhere else. So, you can capture the behavior of the user the user spends eight hours of the day here and if he only charges four hours we have a lot of mobility. The uses are forced to remove their vehicle. It really depends I would say the trade-off is between the amount of people you have with how many vehicles you have. You can get adjust of how much do you have to apply smart charging controls. It depends on which business, so I don't know if I answer that question. Let me know.

>> Excellent. I have another question that comes in here this one is from John. It seems to me that home-based systems would work best it would predict consumer engagement and connection. Any thoughts there?

>> I totally agree on the predictability and the timing and the capability pair really comes under that compensation problem. Of how you compensate the owner for the use of their battery pack as JR pointed out the price of a cup of coffee. Are you willing to participate? There is been some work and showing that doesn't impact the battery very much. You need to be assured of that. Maybe we have to look at is part of the system as long as you can assure that it doesn't do any damage to the battery. Connecting and providing flexibility to the user. It's really how do you value it what is the value to the distribution system and how you get that to the owner.

>> The other aspect of that is charging once they are home. Which again as we get longer-range vehicles that is going to mean more and more power at this stage of the market the dimension is limited you might come in at 34% of capacity so what you have to give is relatively modest.

>> There was one other thing I wanted to mention you may not see a preface experiment. What is interesting is that people still willing to be part of the program even if we give them \$0 but they still required something else and exchange. Whether that be a guaranteed battery charge or 95% when they leave in the morning. We even tested an idea of providing recharging equipment to residences as a mechanism and locking them into some contract. And have them sign up first smart charging program. And then you will receive a penalty if you opted out too many times.



All of these trade-offs were all very significant and so it goes to show there is a lot of leverage in this and it is not just monetary people were just willing to do it without anything and still having a penalty in the program. There may be a small sliver of a population who might want to participate pick there is a lot of leverage to pull.

>> So, going to that question of conversation of no compensation or compensation. The form of compensation whether it is to prevent or looking at rate structures we have a comment here. Utilities typically don't know where 50% of the VR EV's are. Work program should change this. One of the policy recommendations you could self-manage charging. Which will change it. As a cost-effective EDI option. Other comments on whole house T Oh, you rate in terms of paying for services.

>> I think moving residential charging times in the evening that you want I don't think would be that hard because of programs like this pick every EV vehicle has a charging timer on it. You just have to know your charge times rates. You do one in your minimizing your cause. I think programs like that can really help minimize that demand to 10:00 p.m. or midnight. I think with some marketing and education you can remind people you could save eight bucks a month you could do this and over the years you could save some significantly important money. But that is not where its smart charging is needed the most. I just want to remind everyone one these critical periods were trying to reduce demand and it does bring up the question what we trying to accomplish a. Is a critical peak hour being his spending \$400 a megawatt hour and more, those of very few periods during the year. There probably only three or four dozen of those a year. That's why I think moving forward looking at some of the other vehicles in their participation may make more sense. Obviously if we are focused on the curve and consuming power in the afternoon was solar is available. May be of we ultimately figure out what it is what we're trying to do with our smart charging policy.

>> You had a question as well about cost and benefits?

>> Yeah, I saw JR's point on demand response for EDI I heard there is been some attempt to plug vehicles into demand response, but I haven't seen any information on that. I was wondering if you could share what you know about the costs and benefits of PR for vehicle integration or print dissipation in demand response programs. What level of participation have you seen?

>> That's a great question and I am afraid of going to disappoint you. We really don't have comprehensive data on that. We have the dram program the companies that I studied also try to participate in that program. And engage residential customers. That was cost-effective from the customer perspective in their efforts to engage customers but there was an attrition over time. The car we still are learning a lot what the customers are willing to provide flexible services. It looks like that varies by income in ideological the large consumers have the ability to respond most. I don't have that many lessons I could share with you that would transfer over or you know I think the other problem that everyone is trying to solve is where all the revenues for these incentives. How is it that the demand response is generating value for a low serving entity or utility whose grid or trying to purchase grid services. I think is a state we are still struggling with that question as where is this demand response actually generate value pick

>> I want to, Audrey I elevated you to a panelist if you want to come on. Audrey you want to comment on the more VR and charger energy pick

>> I want to give her clarification. We do actually have specific VR programs authorized for Deary returns pilot. All have to participate in that. They have requested an extension in that pilot however with the recent approval this is pilot is going to be expanded to all sites. This will really grow into a program. Can I I'll also want to call on José if you are able to join audio and video. And if you have a question you can ask it verbally. Beverly has offered up some data possibly if you want to come on cut, the electric auto Association. Are you able to come on video or audio at least? Welcome

>> Hi yes, we would be willing to partner with you we are equal owners the electric auto Association has over a hundred chapters across the United States. And I think we have some in other countries as well. If you would connect with me I gave my e-mail in the Q&A I could maybe see what we could do to give you that data. Then there would just be of more of an automatic thing that we do. You know where it's not just a pilot program this is what we do is the same as time of use. It is just a thing you do she wouldn't have to make it a special thing that we would have to contact you we would have a more set up with some software.

>> The goal is to try to make it normal and expectation instead of a special kind of transaction pick

>> Who would be for would be the utility because you would -- do utility would pay the customer or reduce the customer as it does with solar imports.

>> Excellent. Who was a welcome I want to see the audio works. It is not active at the moment, but I do appreciate coming on.

>> We have a ton of questions in the Q&A box so where you just switch to discussion mode. If you have a question you want to ask or want to come on A/V to raise it, please do. I will try my best to capture it. Robert had a question as well. Robert, I elevated you up and if you want to come on A/V as well you're welcome to do that.

>> I just wanted to follow up on one of the lessons learned. About the presentation. It said the charging contains predominantly happen in residential sector major upgrades with infrastructure I want to explore that a little bit. Most homes are equipped with enough outlets to support an elf to charger. So, I want to explore why the model came out if we assume people are charging we are not going to fast charge.

>> A few things about that, so if it is new construction then the upgrades are not necessarily large in the sense that. If you get the new theater and you go to the local transmission system and then as soon as the transformer feeds five to ten Psalms -- homes but most of the EV's are going to homes that are already in existence. So, one of the things that happens is if your homeowner and you want to install and even charger in your home, you will need to have a double pole breaker. In most homes you need to upgrade the service. Promotes transformer perspective you are feeding five to ten homes and say one home has one EV charging to add an extra load over

there. Then if the other ten homes adding EV charger then you double the number of homes on energy. So, you need to actually upgrade the transformer and then you can start going upstream. The residual transformer can start going towards that high implantation of PV. Then you can start content you to upgrade to a voltage system. They just released a memo discussing this topic. So, they are having to actually upgrade a lot of their transfer formers. Cousin there are a lot of TVs in the Palo Alto area that is really high.

>> So that says that the stays the same time of discussion about smart charging would apply to present as residential streets Parikh if you wanted to avoid that. It also seems it would weigh heavily on the age. Most modern homes have 200 amps or more service. And they are pretty built with a 50-amp outlet for a dryer Parikh if every house on the street had a 50-amp outlet I would have to assume is capable of supporting it every time they turned on the dryer. In newer homes it wouldn't be an issue in the old homes I would see the issue.

>> I agree with your point but a lot of the homes in the Bay Area are old we are doing a separate project in homes. A lot of the homeowners can put level two charges and it is a complicated problem. From the home or decide if you. The Homer is going to have to pay for all the upgrades and they have to dig trenches all the way to the transformer. It depends on the age of the house pick

>> That brings up a question it doesn't really make sense to operate people's amine as you say if you have good data already to back this to operate something it's going to be better.

>> One of the things we use workplace charging.

>> I want to reach out to you because it our group is organizing a conference specifically on the topic of whether it can have any impact on the vector two 25 I will e-mail you and you can call me.

>> Thank you, José. We had a couple courses we are looking at what was your question to the group here. Welcome pick

>> I just was listening to the presentations and I can definitely identify with the value proposition or the barrier as far as people not really receiving adequate incentive to participate. I've read it is not my idea I've read it in a couple articles in idea of offering a car at cost net of the battery component. Which is the most is perspective part on an EV. To accelerate EV adoption to make getting it more affordable. Alternatively, if you are an employer you could offer a fleet of shared vehicles kind of like a company car, that employees would have as part of their benefits. While this is also assuming a standard work relationship pre-pandemic working relationship where employees come to a place of work and leave their car sitting there all day. I guess what I'm getting at is we need to start developing these kinds of contractual relationships that make it easier position EV's optimally for providing these types of grid services. So, I'm just throwing that out there. You could have three parties you could have the employees the employer and then the third party who is kind of the facilitator and would benefit by aggregating these resources. Food for thought.

>> I know that if anybody else want to jump and please do. One of things will look at particularly is for financing while they're using larger fleet vehicles is a way to help with cost. Knoll you had some response air around the cost of home charging do you want to come on and respond to some of the conversation around home charges.

>> Looks like my camera is. Hi yes in response to Ed teams' contract is with the lab for phase three of the study. The test for all types of DER including charging down to load shapes of 23. Check that box. Next there is a point around upgrades around control. We recently contracted with Enbrel to conduct a 4000-point Thursday of residential customers in California asking if they have the potential to charge at home. The anticipated market for home charging is much smaller than most industry are anticipating. I actually had a question that might've been passed on, but I think it's important that we approach this problem and get a straight answer. Not necessarily from dog or Gustavo. It shows that there is a lack of assistance with the transfer of the information that we need smart charges. When you lead how much energy you need to get before you leave. The attrition rates in the project and Gustavo's point. The really interesting part of that is we can model the benefit of perfect information and imperfect about smart charging. I wonder if you've done that in terms of understanding the foregone of what it costs from the lack of standardized communication to achieve that smart charging?

>> I think that is a great point we haven't run any analysis on that particular one of the things that we are trying to do is all if this is with imperfect information. We know much we change we need to deliver to the vehicle [ Indiscernible by captioner ] what are we trying to collect right now is data and how much energy a driver actually needs to commute back home and to work. To assume that he and she is only charging at work. It is basically they did in this project they asked how much energy you need a how much miles are you traveling. We make sure we deliver this. We had the remaining. It seems that most of the people.

>> [ Indiscernible by captioner ] the perfect the answers and what was actually delivered to the drivers won of the behavior questions we are trying to answer is do people really connect the dots. With how many miles I need and how much do I need to charge. And the answer is no. If that's the case, then it becomes what the point of is asking the question pick how to do we get that information without to know what to do.

>> The answer is that people are unable to be responsive in the mass market. >> Yes, that is what I am afraid of.

>> Can you talk about the app response.

>> The app response was there was a lot of interest in excitement at the beginning. We went on to about, but it has dropped off in the third month and by that third month we have very low response. We had a small sample size, so this requires a lot more study. It was hard to maintain. We worked with L.A. County and they have substations where they come with a nap and you put in your same information pick another provider that is doing this and the person leading the program at L.A. County said he even didn't enter his information pick it is hard to get that. To get. The crux though is one thing it is going to be it will be as critical with larger batteries. A lot of this we are reviewing is with smaller batteries. If you have large batteries less of a risk and it's

something you can't completely ignore. With larger batteries and the number of charging stations you have. If there is a trade-off we have a lot more possibility a lot more control and they are not as difficult, but a lot of people try to do for hours and then there would have to move on. Having the same charge confirm the vehicle through the charging station would greatly ease all of this and you could eliminate the risk of straining.

>> Not a lack of implementation at least on the one side is the lack of enabling infrastructure that we are investing in. So, the inability of billions of dollars of equipment both the Chargers is being implicated by the lack of the ability to share the smart charging. It is only going to get harder we are talking about small sample sizes pick the behaviors are not going to be perfectly characterized by studies. This lack of technology is going to let the great problem get away from us. It is starting to run away from us. They are insisting on pilot after pilot finding the same information. Gustavo's report, Alco, power flex analysis through Caltech on and on and on. They're illustrating this accident during but you are not ensuring that our infrastructure is ready. That is a critical ratepayer increase investment. We are really seeing vehicles that can take care that workplace home charger payment question. By making sure the OPM controls the customer experience. They are implementing experiences to enable this pick if we don't get this rate edit that has been demonstrated through several project through these and others we are not spending the money effectively. It needs to be implemented as the people propose pick

>> On that brilliant note of optimism I want to shift away from our group discussion. We could actually have 15-20 more minutes on this, but we do have to end here. This is not the end of the discussion. What I think he just raised there is what we are trying to capture. We are trying to make sure at the end of the day about these key lessons learned and the insights from these projects. As we are tackling these big policy decisions having this information at the right time is important. What we going to be doing here with this information coming up next. We've had Act III excellent meetings. Will be pulling those in to those into a set of findings. And we will have a final report and that will be distributed out over the next couple months to participants. If you have comments or other input that you would like to provide as we are looking at that learning. Or your final thoughts that you really want to get in here. Final thoughts of resiliency's and vehicles. Please put them in an e-mail or in the chat. Please send them to us to as work to develop test. The next big thing we are looking at is a policy and innovation for empiric that will take place in February. We will pull in some of these panelists from across our meetings along with some other policymaking meeting makers. One of these things that we pulled that we can stress out right away is where are there opportunities for us to look at. I think there's going to be essential plan by far our Q&A box turned out to be a great social networking thing today. People want to share their information please send it. To the e-mail that I mentioned, and we will try to capture that in the form planning that we're doing. We're really trying to plant opportunities on how we can work together and how we can tackle some of these questions on the coordination side. And we talk about what are some of your takeaways that can be acted on. So, I really appreciate a panelist here today. I appreciate all the staff that participated as well and there's a people across the country that joined us here today on this topic. And I really approach -- puts appreciate participants. There is a survey we are trying to get info on. Please click on that survey and it asked questions. It talks about how the content in the hosting of this and some of the core questions that were asked to hear about opportunities for furthering some policies. What is ripe and ready, and will we be looking at going forward. So please send us know so that e-mail below

that survey and look out for the final report and please join us in February for policy innovation form. Thank you everybody. Have a great evening