

**EPIC POLICY+INNOVATION COORDINATION GROUP
WILDFIRE MITIGATION WORKSTREAM – MEETING #2
OCTOBER 6, 2020 11 AM – 12:30 PM**

Welcome. Thank you all for joining today. We want to thank everybody for joining us today to discuss an important topic. It is critical for the lives of the people of California. My name is Andrew. I am a California Public utility commission consultant for the epic policy innovation and coordination. We deal with the utilities commissions and their role in overseeing epic. This was created back in 2012. It was recently extended through 2030. The CPUC launched the innovation group earlier this year. This was to gather insights and lessons learned from epic and electricity research and development and deployment by different states. We wanted to identify opportunities for collaboration. This epic policy and innovation coordination group develops four work streams for 2020 in areas that have been determined to be critical and timely for decision-making. It deals with equity, electrification, fire mitigation, and public power safety shut offs. Today is the second meeting of the wildfire mitigation WorkStream. The first meeting was held on sip number 23rd. The first mitigation WorkStream, we had a discussion regarding epic products that were working on data modeling, analysis, and risk. We were working on climate change modeling and its impact on qualifier planning and risk. I want to acknowledge the other epic policy participants that are joining today. This includes the epic program administrators, the California Energy commission staff and advisors, utilities, PGE and SDG&E and staff. We would like to recognize the commissioners and advisors that will be joining us today. I want to also recognize Rebecca and Amanda with the QR group. They will provide helpful information in the chat and Q&A boxes. If you have any questions for us in this process, please reach out to us on the Internet. We are here today to discuss wildfire mitigation. Again, as a reminder, the overall goal of the wildfire mitigation WorkStream is to give you insights or policymakers, investment decisions and all of this is around wildfire mitigation. We want to inform the work of the EPIC program. Today's meeting, we are going to focus on presentations by epic projects. We will deal with wildfire mitigation pilots or other awareness sensing, predictive maintenance and other technology solutions. WorkStream will conduct three meetings. This was between the first one we did in September and December 2020. Today is the second meeting. The third meeting will take place on December 2. We have several good presenters here today. We are going to talk about their research, their pilots, and their ongoing work. We have Melissa to start us off with a little bit of background for the CPUC. We have Lisa from PG and E. We have one from

SCE. We have representatives from SDG and D. We have Harry and friends from PG and E. They are going to give 5 to 7 minute presentations. Then we will do a panel discussion and a question and answer session. We have asked the speakers to address some or all of the following core questions and their presentations. First is how can we evaluate the cost benefit of the status quo versus new technological upgrades? How can we decide what technology your strategy is the most effective from a location and a cost perspective? What specific technologies or asset management strategies can measurably reduce the risk of a false becoming an ignition? The presenters will keep their presentations short, hopefully. If you have questions for the presenters, please include them in the Q&A feature on the right-hand side. If you do not see it automatically on your screen, please look at the bottom right-hand corner. You will see a few buttons. It might be hidden behind three dots on the further most right-hand corner. Please use, if you are an attendee, use that feature to post questions as we go. When we get to the panel discussion for the Q&A, I will answer them. We have selected the presentations for today. I also do want to make a note that we are looking to identify new presenters for the next wildfire WorkStream meeting. Through that meeting, which will take place on December 2, we are looking to focus on identifying new opportunities for a collaboration such as technology demonstrations, that accelerate innovation of new and emerging wildfire mitigation technologies, solutions, and strategies for electric utility applications. If you or someone you know feels that they could provide valuable insights, the same types of questions we will be asking the presenters today, we would be happy to hear from them. We want presenters to give five or seven minutes to present on precommercial, emerging technology. For more information on how to apply to present at that meeting and for more background and the types of technology we are looking for, please visit the website. If you go to the main page, there will be a box right at the top. It has a link that directs you to more information. Or you can click on the news button up at the top. Applications to speak at the December 2 meeting are due by October 30. We urge you to send it earlier. This is so that we have time to look at those and evaluate those and move forward. Please note that there may be one or more [Indiscernible] or commissioners or advisors who may be attending today's event. We have no official commission action that will be taken at this event. If you are having technical difficulties, today, audio or video problems, please contact Amanda at the email address on your screen. Again, if you have a question, please use the Q&A feature. That is the box on the right-hand side of your screen. If you cannot see it, please look for a button on the furthest bottom right corner of your screen. This meeting will be recorded. It will be available online hopefully by tomorrow. This will be at the website. You should also be able to see a live transcription of

the event if you look at the multimedia box on the right-hand side. If you look in the chat box, Amanda is providing links to the Spanish translation of the events as well. So thank you for joining today. I want to start us off with some background. I want to turn it over to Melissa with the wildfire mitigation activities. Welcome.

Hello, can you hear me?

Yes.

Good morning, everyone. Thank you for having me here today. I will try to provide some background on the wildfire safety division and the mitigation activities that we are undertaking. We are relating those 2RD and D. I am the program manager over the wildfire mitigation branch. It has responsibility for reviewing wildfire mitigation plans in the newly formed wildfire safety division. Next slide please. So we formed the wildfire safety division. We came into existence on January 1 of this year. We hit the ground running. We are guided by this thought, this vision in everything that we do. This is a sustainable California with no catastrophic utility related wildfires that has access to safe, affordable, and reliable of electricity. Next slide please. I want to give you a little bit of an orientation where we want to go. This is a slide that we put together earlier in the year. We have made a lot of progress on all of these fronts. However, I think that this is going to be an ongoing process where we are going to have to work together for many many years. I do not know that there is a destination that we will ever get to on this. This is aside from the overarching goal of reducing utility caused wildfires. We are looking to increase collaboration. We want to break down silos. This is not a problem that can be solved by any individual utility or any individual researcher or any individual member of the PUC. We want to understand local perspectives. This is how the wildfire events are affecting the local community. We want to understand this on a granular level. We want to know how the mitigation activities are working and what the best mitigation activities are. We are looking to build long-term resilience and we are really looking to make risk informed data supported decisions. A lot of the RD&D will come into that world. Next slide . Just to give you an overview, I am focusing on wildfire mitigation plans. I wanted to just introduce you to some of the other areas that the wildfire safety division is working on. We are also doing our own safety culture assessment with our particular lens of how the culture of an organization impacts wildfire outcomes. We also have responsibility for issuing safety certification. Several of the utilities access this. The changes the standard of review when it comes to utility caused wildfire. Next slide. I am trying to race through these so that we can get over to the meat of the presentation. This year,

the 2020 year, this is the rubric that the wildfire safety division used in evaluating wildfire mitigation plans. The first was the comprehensive and complete section. The second, this is where the RD&D will come in. Are the initiatives that the utilities are using technically feasible and effective? Do they reduce risk? Are they an efficient use of resources? Are they cost-effective? Are they designed for maturity and growth? The goal is to be constantly driving forward, not resting on our laurels that we have found the solution. Again, this is the rubric we will use this year. It might not be the rubric use every year. I think there are elements like environmental impacts that are also incredibly important. We will be looking at those more and more as time goes on. Next slide please. So the meat of today is the why RD&D? All of the mitigation plans have approved RD&D spend on pilot programs. Several of those are EPIC approved projects. Really, this slide covers essentially what the questions are today. This is that we have those questions. We really want to understand the risk. It is not just the risk globally but is the risk that is at a granular level. That data is key. We are working on standardizing data, making it accessible, making it up to date. We want to create data that can be compared across the utilities. Looking at the mitigation measures themselves, there is obviously no one size fits all solution. A modern problem requires modern solutions. So we really want to see how can we reduce wildfire risk in a tailored matter? This matters on a local level. We want to understand at a circuit level, what is the best solution for that particular area as opposed to what is just a global solution that can be applied across an area? And then of course cost is really important here. So what are the impacts and how can they be reduced? How can we reduce risk for the lowest cost? If we were willing to spend anything, we could probably get risk down to zero. It will probably never actually be zero. There is a cost that we have to take into account. This is the lens that we are looking at going forward. It dovetails very well with the questions that are being asked today. That is it. The next slide is just for questions. I'm happy to answer questions at the end. This is the wildfire safety division's website. Feel free to go there. It will get you to the Mott wildfire mitigation plans and anything else that you would like to get to. Thank you.

Fantastic. Melissa, could you offer your email address and contact information in the chat function?

Yes, absolutely, I will do that.

Fantastic! We are going to jump right into our next presentation. This is from Lisa. She is with PG and D. Lisa, would you like to get started?

Sure, great, thank you for having me. I am here to talk about the Eric two, three, four. We evaluated radiofrequency sensors. Next slide. So what we are going to talk about today is the issue addressed and the project objectives. We will talk about the key findings and conclusions. We will look at a comparison of two technologies that we evaluated for purposes of having a comparison. Next slide. The issue that we sought to address was predictive maintenance. Just-in-time maintenance has the potential to lower operational costs and they do this in several ways. First of all, you are able to find asset conditions. This will ultimately result in a fault and intervene to prevent those faults from materializing. You are not doing extra maintenance. You are just doing it before the issue has a chance to become a fault and a failure. And when assets do fail, and there is a fault, it results in where and tear on the distribution grade from having that high current go through. And then, although there is real-time continuous monitoring of the distribution as it lets you find rapidly emerging conditions. The health of the distribution is dynamic and subject to the stresses of weather and operation. We did some predictive maintenance strategy also. We reduced our risk because we would intervene on asset conditions before they have a chance to fail and possibly cause a wildfire ignition. So in this project, we sought to evaluate early fault detection, network monitoring technology from one I NDP in Australia. We also wanted to deploy distribution fault anticipation technology in the substation to compare what the two technologies were detecting and then contrast those. We also wanted to evaluate if these technologies were ready for production, rollout. Next slide. So we found that the radiofrequency sensors were effect live in letting us find deteriorating asset. The way that we ran this project is after we got these technologies deployed, we monitored the systems and then when we had condition that looked persistent and serious enough, we sent trouble men to do field controls and in many cases, we were able to find asset conditions right in the location that the sensors were telling us to go. We found things like damaged conductor with bird caging. We found a bullet in the conductor. We found conductor strand breaks where they were unraveling and starting to become closer to the other phases. And so, we do feel that the early fault detection sensor technology has the potential to reduce our operating costs through productive maintenance and to reduce hazards that could result in a wildfire ignition. We also had, you know, through this project, we evaluated the [Indiscernible] technology. And, it is not as strong as letter EFD because it cannot tell you the location of the fault. It has an entirely different mechanism of detecting the problems. You can often get more information out of DF letter a on what is going on. We found having both technologies together provided us a lot of insight and ability to respond more effectively. So we conclude that these are both promising tech knowledge is to help us with predictive maintenance and the early fault

detection sensor technology is going to have a next generation version next year with quite a few of the improvements that we identified as desirable. And so we do plan to trial with our operating budget the next generation of technology. This will be next year. When we deployed for the pilot, it is not terribly efficient. This is because it was Phil in work around other higher priority work. We did not get a really strong sense of the efficient deployment cost for EFD. We just did the back of the envelope calculation. It looks like the payoff period for letter EFD is something on the order of four or five years from the operational savings. Of course, the risk mitigation, we cannot really put a price tag on that. Next slide. This is a comparison of the two technologies. Where they found the same events, it tended to be long arcing events. For example, we had a couple of fuses fail. They both were able to detect that. We also have an arcing conductor clamp that they both saw. The letter EFD, it is very sensitive. It can detect vegetative encouragement. It does not do this through a single event. It is monitoring for partial discharge every second. And then you plot that on time location axis. And you can see these hotspot develop on the grid over time. The DF letter a is more of an event processing solution. A gives you time sounds and does the classification. There is actually some improvements on the letter EDF roadmap. This will allow these two technologies to overlap on even more events. They will overlap less on higher, more frequent monitoring from the solutions. And so, we are continuing to evaluate and plan our strategy around these two technologies. And that was it. Thank you. The Mac I am going to get one question in. I really like that question but we are going to present that back when we come back to the Q&A. I have seen a couple questions coming to me directly. If you can police put those in the Q&A box, if you cannot find it it might be behind three buttons on the bottom right-hand corner of your screen. Take a look at those and we will get to the Q day. Up next, we have one with the Southern California Edison.

Yes, good morning everyone. This is one. I am with California Edison, I am with the great technology and innovation team. Thank you for the opportunity, next. So I am going to talk about three basic project. One is continuation and another is a new project. Let's talk about advanced technology for field safety. Before I get into the subject matter, I just wanted to clarify two terms. One is virtual and augmented reality. These projects are focusing on augmented reality. What is the difference between augmented reality and virtual reality? Virtual reality, you can think of something that takes full control your senses. This means that you create a reality into a virtual environment. It is based on a real model. You can think about a videogame. It is creating a space that is actually referring to an actual real space. It is not real. Augmented reality, on the other hand is more about enhancing your senses. Really, you are still looking at a real, real system or real image in time. It is real time. All you are doing is you are enhancing the image

that you see utilizing these technologies. So, I just want to make clear that these two terms are not used interchangeably. They are completely different and separate peer so this is some of the industry trends that we have seen in the augmented reality space. So once again, [Indiscernible] is becoming more and more propellants. We all know that companies like Apple are working in this phase. It is becoming more and more accessible to us. Obviously, there is still a cost question. This is as everything else. We believe that in time because of the adoption of these technologies and the trend, that cost needs to be reduced. We are trying to start looking at these projects based on the demonstration of augmented reality. We are keeping an eye once again, not only on the technology but on the device itself. In this case, it is the glasses. Next slide. So this is the epic two project. It was really looking at the use of augmented reality. This was basically to provide, in some ways, training to the field. Basically what you provide is an augmented reality environment, using a [Indiscernible]. Then you can go and train people in a controlled environment. If a may say that, I am showing an example of a switch. Once you put it on the iPad, they can actually see what each one of these different buttons and also all of the different functions of this device without having to put labels on that. We have that information readily available. It can be used for training purposes. You can put in different areas and they can react to the scenario. The other thing with this project is once again, it was a first step. We had a couple of use cases. We wanted to use those use cases before we move into a much larger if. This is what we are trying to do with the next project. This project was the first step into looking at the use of augmented reality for training purposes. It was also to support the cruise in the field. Next slide. So one of the things that we found and you can see, this is one of the actual installations. It deals with a trial for the augmented reality system with field crews. You are not only providing this information in real-time, meaning that if there are changes to the manual, you have got to publish a new manual. It takes all of that information to the field. In this case, when you are using this technology, you get the sense of the dynamic. What I mean is you provide information as the information changes. Let's say you have a new person and this new person of this relate has this feature that was not available before. You are able to make that change right at the bottom. The field crews have access to that information in real time. If you were to make these kind of changes, you could use the methods that we have now. This is big bird. You have to make sure the information gets to them when it gets to them. We hope that it is not going to be in real time. The other thing is you have information here that sometimes you might have to refer to a manual. In this case, you can use the augmented reality to look for the information that you are looking for. That is one of the things that we have thought about. We want that system expertise. If you are looking at

something, you can invite somebody who has a different understanding of the product, of the issue. You can ask for advice in real time. Both people can be looking at the same thing. This is without having to have somebody. The system will do it for you. I just wanted to get back to one thing that I forgot to point out on the last slide. The challenge, we proved the technology that augmented reality brings a lot of beautiful things and benefits to the cruise when it comes to safety. However, you notice that they are still using their hand. They are taking two hands that the cruise need to use to do the work that they do. You are providing information. At the same time, you are taking one of the abilities which is the ability to get in touch with who they need to be interacting with. Next slide.

So really quick, the EPIC project is going to hook up the same lessons learned. This is to utilize the augmented reality. You need to apply it to the classes. We are taking once again those hands away from the crew and we are making it safer for them to interact with the equipment. May be during the questions, people have questions. The next one is the distribution reform project. The point of this project is to utilize existing infrastructure to obtain data. In this case, it is waveforms from the equipment. It deals with different events that happen. So basically, this is kind of sort of VFA in a different way. We are looking for an open protocol. This is something that we also have access to the raw data. If you look at the [Indiscernible], I am not saying it is bad, it is a different approach. You do not have raw data. In this case, with this waveform analytics, you have that information. Also, we are trying to actually address issues that might be seen by different groups, different people. For instance, this deals with information that the protection engineer does not need and vice versa. You are trying to deal with a wider range of benefit that have the ability to obtain these waveforms. This can give you not just one set of people and groups, the various engineers, operations; you have access to everyone. It enhances safety. Some of the potential benefits as I said is the increase of Stacy, reproved reliability, it reduced cost. We are looking at the reduction of cost because we are looking at products that are probably a little bit cheaper to not only install but also to procure. You know, we are already working with the different vendors to try to find those opportunities. We are dealing with operational efficiencies. We are trying to find a product that is installed. There is no need for sufficient attitudes and things of that nature. When we reopen waveform analytics, it is in real time. Things can turn. That information can be given to you in real time. The last slide, I am sorry. Here is what we are talking about addressing or continuing to look into technologies that can help us address wildfire risk. Once again, the objective is finding monitoring instrumentation that can help us support the assets and information regarding the wildfires and mitigation efforts. I do not have much time but during the Q&A, maybe people will have more. I will give it back to you.

All right, thank you one. Quickly I will move over to a presentation. I think Misha is going to lead this one on behalf of SDG Andy. Chris Thompson, I think you are available via audio. Are you online, ready to go?

Yes, hopefully everybody can hear me.

Great.

Yes, I am with wildfire mitigation with SDG Andy. Thank you all for having us here. The first slide, over the years, wildfire mitigation has been a huge focus for us. This slide gives you an overview of the risk management. This is a companywide process that happens every year where leadership discusses the top risk across the company and compares them. Wildfire is our top risk. Wildfire is the top risk in SDG&E's risk management. The next box focuses on the wildfire, next generation system. It is also called wings. It is a risk-based tool that will help determine how best we can mitigate the wildfire and where we can make future investments in hard things at the segment level. I will go over this and a little bit more detail in the next slide. The last box here is a real-time operational decision-making tool. This really guides us in helping make decisions during the high risk weather event. So this slide is intended to show the current state and how WiNGS is going to be different. We talk about it in terms of the spectrum of granularity. Today we have tools to do the risk assessment at the asset level. This looks at poles and wires and it gives them a risk at the asset level. It is based on failure rate and consequences. Then we prioritize work based on that. We do this at the asset level and it is applied at the system level. This then goes into the [Indiscernible] and ERM process. We needed something at the asset and system-level. We are making decisions at the segment level. When I say segment, it is basically multiple spans and structures between two isolating points. Next slide. So really, the idea is to leverage the asset level analysis to inform the segment level analysis. This will then aggregate up to the system-level analysis. This is the system-level as a whole. So the scope of this model is really on the distribution side. It is in the [Indiscernible]. So we can now provide a current segment level risk. We can also assess what the future risk level will be if we were to apply and mitigation. We can really do this cost-benefit analysis and a comparative analysis. It helps us apply like a risk factor at the segment level to see, what is the most appropriate mitigation. You know, whether it is underground, strategic underground and, is it conditional hardening? Does it have a conductor? Is it providing generators to customers? Next slide. So something that is new that we have not done in the past is for each segment, we are giving it a wildfire risk. We are also giving the segment a PSPS risk score. If you think of that, it is really a

mitigation. We would like to quantify the impact of that mitigation. Basically, what this model is going to do is it is really going to help us answer these three questions. What is the current risk level today? As we mentioned, each segment will have a fire risk, a PSPS risk based on likelihood and consequence data. Then it will tell us what mitigation is the most cost-effective. Depending on the risk score for you know, whichever mitigation you pick, what is the benefit? Did we get the biggest bang for our buck? It is a good project or not? At a high level, you know, what is the right mix of strategies? This is more a top-down approach. This is where we do a cost-benefit analysis for each of the scenarios to see how much benefit we got. And we will see if we got risk reduction and how much. Lastly, we are in version 2 for this model right now. We have the concept. We have run across our segment data. We are starting to make some directional decisions around it. With that, next slide please. I think, Chris, are you on?

[Silence]

Okay, I will cover this. SDG&E is always forward thinking. We are looking into technological advancement. How will we mitigate the risk of fire? I want to highlight some of the programs from a technology standpoint that we would like to talk about. One is the flow and conductor program. This is where we prevent a fault from becoming an ignition. We isolate the fault before it hits the ground. We have equipment replacement that is key. That is with the operations deal with. We have drones. That is a great inspection tool. You know, there is a lot of potential for this technology to take off. We have situational awareness. We have the artificial intelligence based on predictive models for weather. Next slide. Lastly, you know, vegetation management, that is an equally important and effective tool at reducing wildfire risk. Technology, you know, we are continuing to evolve. We are enhancing the vegetation decks. We have a field management program along with some other stuff and we are really trying to move forward with it. With that, I think I am all done. Thank you.

Thank you very much. I think we still have some questions coming in Q&A. That is great. Please continue to add your questions to the Q&A box. We will get to them at the end. Last, I have a presentation here from PG&E. Please, I do not know which, Harry or Franz can start. When you are ready, go ahead.

Harry, I think you are on mute.

You are still muted, you might be personally muted.

How is that?

There we go.

This is Harry. I am the manager of distribution and automation. I just wanted to talk about the epic 3.15. This is the rapid earth current limiting project. I will have Franz, who is our lead engineer on this project take you through the flight.

Okay, the primary objective is to demonstrate technology which automatically and rapidly reduces the flow of currents. It reduces the risk of admission for single ground faults. We split it up into two tasks. One is dealing with inspection and phase 2 is dealing with field testing to quantify the performance of the technology. So we are basing our metrics for this technology in line with the Australians who have implemented our tech elegy at numerous substations there. We are looking to measure the voltage at the fault site and make sure that it is decreasing to certain levels within a certain limit of time. Next slide. So key accomplishments to date for the project are we completed the detailed design and construction has been underway for installing the equipment in the substation and the supporting distribution equipment upgrades. So this digitalize is it and it has been delivered. [Indiscernible]. We also created a proof of concept testbed using a real-time digital simulator. We have interfaced the control hardware from the supplier into the civilization regarding the equivalent technology. This established the detection threshold. Construction is ongoing. Some say it is nearly complete and we are working on the distribution construction right now. We are training our operation's personnel. This is due to the fact that the technology operates much differently than the grounded circuits. Next slide. Some of the key learnings that we have observed, this is some of the testing that we have started. We want to reliably detect and mitigate faults over 14.4 kilos homes. This is world-class fault sensitivity. It is mitigating the current associated with that. Generally, the vegetation contact is in the realm of computer ants and traditional protection has a difficult time with detecting this. The capacitive balance is critical to achieving this level of sensitivity. So we have worked with a supplier to develop a new type of equipment called a capacitive balancing unit. We balance the capacitive currents and we maximize the sensitivity. Maintaining this balance is difficult through operation of the circuit. We have studied and reviewed the circuits. We have determined that we need to replace fuses with a fuse saver to maintain balance. Also, we need to balance each line zone so that the line [Indiscernible] [Indiscernible]. And the primary connected equipment must be rated to withstand the higher voltage. This technology is an extension of residence grounding. When there is a fault, the healthy phase sees higher voltage. So all of the equipment needs to be [Indiscernible] for this increased level. We have had to increase the voltage

regulator in the substation and replace cable and also install an isolation transformer for a primary connected customer. Lastly there is the arc suppression coil. It deals with inadequate tuning margin. This deals with the number of circuit miles and the number of circuit miles of cable. For this project, we have 100 amps. Next slide. So the next steps in the project, we are in the process of completing the construction activities. We are looking to commission the GFN to stress test later this year. We will start field tests at the end of this year. In the next year, we are also going to perform fault testing on the circuits. And, we will operate the circuits through storm season. We will have the GFN in service and we will collect real-world data. We are also in the process of doing additional substations for additional deployments of the technology. This is in our highest fire threat districts. We are in the process of selecting the next five substations and performing the same tasks such as we have done on the demonstration. That is it.

Excellent. Thank you. I appreciate that we are able to get down to the time point here. Welcome Chris Thompson. He is hereby video. Please check your audio if it does not work. You are able to get on. We really appreciate it.

Can you hear me?

Yes, we can hear you great. We are going to start heading into our Q&A session now. We have had several great questions. This is in the Q&A feature. We have also had some questions in the chat. First I would like to recognize the commissioner. Welcome and thank you for joining us today. We wanted to see if you had any questions or remarks for the panelists to start us off.

[Silence]

[Captioner Standing By]

Send me a note and I can put you back in. Excellent. So I do have a question that I would like to start us off with today. It actually comes back to Melissa's regular slide. This is a question about risk. Raise your hand if you would like to answer this question for the group. Where is the risk the greatest? What is driving the risk right now from your perspective? This is based on what you have learned from your project. If you want, you are on mute it. Would you like to tackle that one first? Then we can go to Harry.

Yes, regarding the project that I presented last, it dealt with the risk. I think the risk is in the development and the level of confidence that we have any

algorithms. You are going to make a decision based on that information. I think the risk is there to make sure that we approve those technologies and we test those technologies to you know, to the end. Once again, you are going to be making decisions with this. The decisions that you are making, needless to say, they are critical. The risk is there. We have to not only get to a level confidence that we are going to be using that information but most important, we need to make sure that we do extensive testing. These are new things that we are looking at. We are dealing with protection relays. I'm going to do with protection relays for one second. We have been dealing with this for many many years. This is not new. Win are almost perfect. We know know what to do with them. This is so new to us. Artificial intelligence, augmented reality, things like that; they are not really in line with the work we have been doing. If you ask me, that is the way I see it. It deals with for us to have the ability to [Indiscernible].

Harry, would you like to answer that as well?

From a risk, the risk that we are working on mitigating is the wired out condition that can [Indiscernible]. The project is deploying this new technology in North America. This has never been done before. It is really about getting everything installed, this is with all of the challenges that we have had this year. There is the epidemic and everything else. It is about getting the system installed, operational, and improving the concept.

I am going to go on to the next question. There was a question that came through about how soon or when with these types of tech elegies exist on the grid. About how long are we looking at here for the technologies that we are evaluating now? How long until they are in that deployment? If you choose to go ahead with that, I will clarify.

I will make a little comment. That is a question that I still have for our team internally. I think some of these technologies will mature with the market. Once again, let me go back to my presentation of augmented reality. We are relying also on the market to mature. Obviously, we have got to do a lot of work for our specific needs. Once again, you have got to think about it. Maybe today, the cost is too high. If you want to deploy, you know, augmented reality glasses, maybe the cost is high. But we know that as this gets adducted by other interest trees, the cost will hopefully come down. We are tracking it. The timing, it is a question of how soon do we have affordable access to those technologies? We want to do the homework now. This depends on when the technology will be more available as far as cost wise. We are ready to implement. Again, once again, it is how the market plays out.

Does anybody else want to take that on? PG&E? SDG&E?

Hello, this is Lisa . For the EFT and DFA technology, we are going to do an expanded rollout next year. We will continue to assess the benefits and cost. We are going to start focusing on our high risk, high fire threat districts. We will deal with some other modeling to pick the best circuits. It will start next year.

Misha or Chris, does anybody want to tackle that?

We have clarification and a series of questions about granularity and how much expenditure needs to go to get sensors in the field. There is a question first for Lisa around the IND, EFT. This is a great Myers-Briggs test that you have going on there at the utility. The question is what density of sensors need to be deployed to get full coverage where as ESE, and mobile technology it is not a Mac?

This is a fixed technology. You deploy a sensor approximately every three miles. You do this on the mainline and significant branches of the circuit. We have modeled a couple of circuits. One was a very long and heavily branched circuit. It would take 34 of the sensors. Another circuit was 12 KB rather than 21 KB. That would take 19. So the average is probably around 25 sensors per circuit.

Okay, excellent. I have a question for Misha as well. There is the question coming in about the geographic so of the segment. How big is the segment versus the asset? Obviously, this is for the system as a whole.

Can you hear me?

's yes.'s

So on average, it is about five or six circuit models with about 100 or 200 polls. We have about, approximately like around 600 segments. We are still defining them and clarifying them.

Excellent.

I have a similar question for you. So the question came in the description of the distribution form, the analytics at a very high level. What are the specific sensors that are included in the open platform that you mentioned? How do you collect the labels?

That question is for me, right?

Yes.

Okay, we are utilizing the existing sensory. What I mean by sensor is the CT and PT. It is nothing different. We are trying to really leverage that. Remember, this is nothing different, and I would not say nothing different, what I will say is the difference between existing technologies like digital full recorders, [Indiscernible]; --

Can you restate what you just said?

Are you losing me?

Yes.

This is similar to existing technologies like digital full recorders and relays that capture this information. Now what this is doing, in addition to that, it is adding the artificial intelligence piece. You are taking [Indiscernible]. You deal with the relay tape and the division of the recorder tapes. It takes that information and to translate that into something that you cannot use to make the decision. Right now, you have got to do all of that work by hand. You take that information and you have an engineer, they sit with the software and they do their analytics. This one is taking that out of the picture. It is utilizing or enhancing it. It is not only capturing it but it is using the artificial intelligence and machine learning algorithms in order to get more out of those forms that already exist. We are not touching but we are adding a lot of hard work to it. It is really just an extra, additional piece of equipment. We are looking for something that is not as expensive. We are looking at that as 12. Basically, that is what it translate into.

I want to go back, there is a follow-up question. The question came from Richard Lamb. Is there a reason for higher segment level risk versus a more granular asset level risk? Is there a reason for that?

I am sorry, could you repeat that?

The question is, is there a reason for higher segment level risk or this is versus a more granule asset level risk?

Yes. It is because it is more for PSPS decision-making. Really, we want to be able to , we would not make the PSPS position at a very granule level. We would not do it at the pole level. It is more segmented. This deals with two isolating points. We do use the analysis to help make decisions at the segment level.

Okay. I am sorry to pick on you but there is another question for you as well. What factors go into assessing the risk? Maybe Mitchell was not clear on SDG&E. I want to remind folks. We have another PSPS work series meeting. We will dive a lot more into these topics. Go ahead.

We are using estimates. We are seeing what is the probability of a PSPS. On the consequent side, we are looking at [Indiscernible]. Is that something new? We are trying to see if we can quantify the safety impact of it. We are working through it right now.

I want to remind folks that if they have questions, please send them in using the Q&A feature. It might be on the right-hand side in the lower right-hand corner. I want to pose questions for PG&E. I do not know which presenter this was for. The first question was and I do not know if this presentation is responding to yours. How is this related to PG&E [Indiscernible]?

I will take that. Deals with the automatic thought location and service restoration programs that we have had running since 2012. That is totally different here than what we are doing with this project. This is to protect and predict defaults. This deals with after a fault has occurred.

This question is a follow-up. It is a follow-up to this other question that is here. It is that it is very interesting to hear about PG&E policy. Are you considering any technology that deals with line to line policy?

Currently, the protection system is capable of seeing a line to line type world. What we are reviewing is the option of using distancing technology or the distancing relays and re-closures. During extreme and wind conditions, we want to switch the settings all over to an instantaneous trip. We will sacrifice coordination between devices. We will trip as fast as we can for a line to line. This is so we do not have a repeated line flapping together. When we do, we clear it as fast as possible. We also could be thinking about leveraging the information that Lisa presented on the line sensors. As the wires are approaching one another, the discharge starts. That will be used to trip the protective device before it makes contact. So there are a couple things that we are looking at in that space.

Anybody else who would like to talk to that question? All right.

I have another question. This is directed to one. Can you explain how the AR technology is directly related to wildfire protection?

Okay, this is more about safety. It is about worker's safety. We do not talk about how this could apply to wildfire mitigation. That said, it is something that we looked into it and we can potentially look into it. Right now, this is mostly focused on keeping our crews safe when they are doing the work.

So if you are a panelist or if you have a panelist link here, please click on the raised hand feature or let us know if you have a question that you would like to pose. Judy, do you have a question you would like to ask?

Yes. This is to the augmented reality and to touch very briefly on using glasses or something like that, this is so that the crew can be hands-free. I wonder if this has already been used in things like solar installation or if this is not yet really implemented. I think that is the real wonderful lead, it is having all of that information but also having the ability to do things.

I will chime in a little bit on that. Once again, this is a project that I heard of. They are not using this technology yet out in the field. They are using this in powerplant maintenance. They are looking at a much closer environment. You know so, is it being used? Yes. How they are using it, I asked that question to the person who is working. This is mostly for maintenance. Once again, they are using this as a proof of concept. This is what I heard from the person who was working on it. I do not have a full-blown case here but these are just questions that I asked. It is dealing with the cost. If they want to deploy this out in the field, it is still a question of how much it will cost to recruit. Right now, they are really focusing on power plants to find the use cases. As I mentioned, I truly truly believe that once this technology reduces in cost, if we are ready, of course, we have to be ready. Then we can take advantage of that.

This is Cameron with Southern California Edison. I might add that I think this augmented reality is going to play well in quality in ensuring quality and installation or in the example that you used, I think you had a RAR that they were adjusting. They could validate protection settings. This does keep workers safe. It deals with fast curve settings, validating those the settings to make sure. I think augmented reality will play to the inspection side of things, we will make sure that components are in the right place, components are in place. I think that once we prove out the concept, it will improve quality on the installation and construction site. The Mac thank you. Yes indeed. That is another thing that I forgot. You can think of an eye phone. When you are doing the iPhone and they

ask you, do you want to bypass things. It puts a little notice that says you did not set up your [Indiscernible]. Do not forget that you did not set this up. You can keep track of changes. This allows us to keep track of those changes, things that have not been addressed that need to be addressed. This is so that you have awareness of it. Things were not addressed and you did not have the information that you have got to use. Thank you, that is a great way to see it.

Absolutely.

I want to pose a question to Melissa. There is a question that came through in the chat. It asks for information. Where can I find information on pilot programs?

Yes, I thought I'd. I can follow up with Bernie directly on that. I mean, it is in each individual wildfire mitigation plan, it is something they had to report on. If you go to our website, you can click on it to get to the wildfire mitigation plans. It deals with the utility's website. I do not have a slide or anything readily available. I can work to find that information.

Great, you can put that link in the chat. That would be perfect for now. The Mac absolutely. I also have another question. It is from the wildfire safety division. [Indiscernible - low - volume]

Yes, that is a really interesting question. I am assuming that what is being asked is in terms of deploying mitigation. Do we have an order that is the best way to go? That is really what we are trying to get at. That is going to vary depending on the topography, depending on the asset age, depending on a whole lot of different circumstances. And so, I do not think we could ever get to a point where we would say number one, do this, number two do this. Maybe I am wrong. Maybe down the road, we will get there. I think there will always be the variance that is going to occur depending on where you are.

Excellent. Franz, you have a question.

Yes, I just wanted to comment on what Melissa just said. Even within service territories, every distribution circuit is different from another one. You have different exposures and risks that different parts of the circuit. We have really been looking at you know, where can we deployed [Indiscernible] where it makes the most sense. If we do still have some risk, then you also have system hardening with that as well. We definitely view it as different things together. We

are still getting a handle on how to combine all of these different efforts and technologies.

I have a question. It goes back to a question that Melissa had originally posed. It should be directed to everybody. This is a question about what information are we gaining now from these pilot projects? How does this help inform broader questions about striking the right balance between risk and cost or asset hardening? What information have we directly learned from the pilot project so far?

Do you want to talk about WiNGS?

I think from the WiNGS standpoint, we are using a combination of analytics and subject matter expertise to make sure that we are taking as much data. If it is these pilot programs, we are taking in as much data as we can to help with the decision-making. We are trying to strike the right balance between the risk and the cost from a quantitative standpoint. We are calculating the RSE. This is a risk efficiency while we are hardening mitigation. And from a qualitative standpoint, we reach out to the experts on the engineering side and we make sure that they can validate some of the alternative analysis.

Andre, let me chime in a little bit on that as well. I think what we are learning is once again, as I mentioned, I think we were talking about new technologies here. We are trying to bring things that may be in the past we had thought and considered but not really applied. We have the belief that this can really help us. Actually testing this on pilots or demonstrations, this gives you the ability to get your hands on it. Actually, you can really look at the data and see if this is a good proposition. As I mentioned on our project, okay, let's deal with the first questions first. Is this really something that we think would work? We games that information. So, in the first steps, that allows you to really continue looking at the tech knowledge he and pursuing it. As I said, it deals with training it based on the market. This is versus saying do you know what: this is something on paper that probably looks really good. After we tested and pilot it, we are learning that we are not ready for this. I think that is one of the valued propositions of this demonstration. This is especially when we are looking at things that we have not used in the past in this industry.

[Silence]

[Captioner Standing By]

I muted myself. PG&E, did you want to chime in on that as well?

Right. Okay. Well, I have a different question here. I found it very interesting. So, the question comes from [Indiscernible]. What are IOUs doing to take advantage of a close fire window of opportunity for lower cost mitigation and tactical deployment? For example, will the underground lines and other assets be given cheaper security and feedback for post-fire roadwork, etc.?

Well I know for PG&E, oh we are looking at the areas that have been in the rebuilt. We are dealing with system hardening. We are dealing with the evaluation, whether it makes more sense to go back to as is. In many cases we are going back to the cover conductor or we are considering under grounding. We are looking at a number of different avenues as far as different routes for the circuits. This is instead of going straight up the hill. We are making sure that we are looking at that. We are also looking at the technology project we have in place. Some of the area was burnt down. We are making adjustments to the project in light of some of the ways that it is going to get rebuilt.

Did you have a question? Okay, all right. I did have a question. Given the technology and the possibility to present it today, my question is more around, are there limitations to where these tech elegies could deployed? Are there connectivity limitations were different types of infrastructure limitations on where you could deploy some of the solutions? Would you target specific areas? Does anybody want to comment on that? Or Craig?

Yes, go ahead.

For the project, there are limitations, they can only be installed on three wires that are connected line to line. It will not work with the neutral systems. There are also some limitations about the percent of underground on the circuit. Franz cover that 100 amps was the criteria that we have used so far. Those are two areas as far as restrictions regarding where we can and cannot put it.

What percentage of your system is for the underground, if you know off the top of your head?

For our high fire threat districts, 80% of those are three wire circuit.

SDG&E?

I was going to say nothing specific to technology or mitigation but really, it is a lot of the permitting issues. You know, we can do this analysis of what mitigation

we want to apply at the segment level. And it really comes down to going and seeing are there any recurring issues? Are there permanent issues? Those are the ones that we have to look at segment by segment and see what we can do. Those are the two that are often in the district.

This is one. In terms of limitations, what I can think of for the augmented reality project, it is really the adoption. Once again, we are introducing new tools. You have got to have you know, you obviously are going to have some sort of, how do I say it? There will be a learning curve from an adoption by the cruise. This is something that they do not use. That being said, I try to remind myself that a lot of the new crews, the last experienced ones probably have just come in. They grew up with this thing. This is not new to them. They grew up playing videogames and that kind of stuff. It is probably a little bit easier. If I think of a limitation, that is one. The second one is balance. Will you strike a balance? Do not overdo it but try to take it one step at a time. We use augmented reality and artificial intelligence and we try to address some of the most critical issues without ever expanding it. Just then, you will have to once again, you will have to get to a project that you have way too much going on. You do not complete something. You have got to have some sort of balance if I may say so. Those are the limitations that I can think of right now.

Great. Yes, and back to the original question or the question a while ago. It was regarding the underground restoration. The restoration efforts, in addition to what I think SDG&E mentioned, there is the permitting issues, there is the technical issues. There is also connecting to secondary services and undergrounding those, going from overhead to underground. Those do not occur fast. The first thing that people want to do during restoration is get the power back on. This is so that they can restart their life and business. I think PG&E mentions that we are taking our grid hardening tools and we are taking them with us. We put a lot of effort into the conductor application. We wanted to reduce the risk. That is most cost-effective and inefficient way to get the power back on. I wanted to just add that on. And then also, regarding the most recent question, regarding limitations, I think that PG&E and SDG&E mentioned a few other good things. Across the portfolio projects, there is other things regarding communication latency. There is communication, 5G, private communication that is critically important to make sure that systems are talking to each other quickly and responding. And then, these pilot projects, in many cases, they are there to develop these limitations and to figure out what they are. Early in the stage of these projects, often times they are not known. By the end of the project, we should have a good summary of what the limitations are. We will communicate those out in the report.

Excellent.

All right, Karen raised a very interesting point. Before I get to it, I would like to pose my last call for any questions for those who are on the account or for those who are in attendance. The panelists can pop up on the screen and I will see a video and I will get to you. The question I wanted to raise here is based on current understanding of where these pilots and the district is going. In your opinion, what is the most likely, most cost-effective risk reduction that we can get in the near term? This is from technology or strategy.

We need to look at the projects that we have or just in general?

Just in general. New technologies, new approaches. What is the most cost-effective?

I am a huge fan of preventing the ignition from occurring in the first place. As a covered conductor, I think this is the most cost-effective and efficient way to meet that need. This is something that we are really focused on. Of course, we need to take into account under grounding. That accents went it is appropriate, feasible, when it is cost effective. It is difficult when it is up against covered conductor. It is certainly a good way to believe and better mitigate the risk. I would say a covered conduct is the cornerstone of our mitigation.

Others?

Yes, I can comment. On a per mile basis, [Indiscernible] is the most cost-effective for risk reduction and risk-benefit. And Australia, they observed, for the big reputable deployment, they had 100 circuit miles or more. It can be a 10th of the cost of traditional system hardening with a powered conductor. So, we are optimistic on our official deployments of this technology. We are planning the next substations. The standard, one size fits all approach is being dealt with on this call. REFCL has a cost-benefit advantage and it prevents [Indiscernible] when something happens. If a tree brushes into a wire and falls to the ground, the technology is there to provide a layer of resilience. We are really looking forward to dealing with the field test and quantifying this moving forward on the circuit.

Excellent. Last comments?

Yes there you are. Go ahead.

I was just going to say, just looking at this, regarding the cost-effectiveness and looking at some of the great hardening options, it is very difficult, we start generalizing today. We might also lean toward a [Indiscernible] conduct her.

Yes, it is in the pilot phase. It certainly shows promise. I know that we have three different favors of REFCL. Some of those technologies work in some places and not others. Once that pilot is proven out and it is showing, that may certainly tip the scales once we have that data. That may certainly tip the scales over into one of the most cost-effective measures in certain locations, with certain wire tipping rations. Definitely.

Chris, you had a quick question or comment?

Yes, you know, when it comes to vegetation management, a good line of clearance, good proper directional pruning, and we have vast growing species beneath the facility; this can be very cost-effective. This is a traditional way of approaching it. These technologies I am hearing about are fantastic but we cannot forget that aspect. It is definitely necessary. It is good for identifying problematic trees. That is one of the things that we have a problem with. We are constantly working on it. It deals with looking at the trees that have the potential. We are finding defects and we are mitigating those defects such that they will not strike the wire.

Excellent.

This is definitely a balanced approach, certainly.

You had a comment that you wanted to make here. It was here at the end.

Yes, I just wanted to bring people paws attention to something. This is not related so much to the infrastructure in terms of natural disaster recovery and rebuild programs. I put in the chat the preceding number and there is a staff proposal, proposed wildfire reconstruction. This gets to the question earlier. It is focused more toward face single-family homeowners and multifamily property impacted by natural disasters. We do have a staff proposal in terms of a wildfire, national disaster resiliency rebuild program. The comments are due on Friday on that. I put the preceding number in the chat pod.

Thank you. If you look at the chat box, you will see a link there, the preceding number is there for comment. I have one last question I would like to get to. This was an excellent question that came in. Given the urgency of our times and

heightened nature of wildfires, how do we shorten the testing deployment timeline? Are we sharing resources through assistance agreements? [Indiscernible]. Thoughts there, how do we accelerate this?

We were provided with this question. I do believe there is a good opportunity here for us to maybe collaborate a little bit more. We are working on technologies that are similar. Maybe given the differences, between three systems, we are not necessarily exactly the same. That being said, this close collaboration can help speed up the deployment of technology. These are lessons, in this case, San Diego or PG&E can learn. I do not have to relearn it. They have already learned it. The ability to share this once again, this can help us. It can help us expedite or push the timeline faster toward the deployment. That is one thing I can think of. Once again, we can continue to finally collaborate and discuss.

Thoughts? Closing thoughts?

Yes, I know that on previous projects, we would kind of take an approach of doing more of the deployment in a lab setting first. We would put the specific product through its paces. So we have transitioned from that to going straight to the field deployment for the construction. This is while doing some you know, smaller still lab testing. This will support the commissioning of the equipment once it is in the field. We are trying to put more processes in parallel. I think that where it is low risk to go straightforward, to the field deployment, we are taking that approach more and more with some of these new technologies.

Excellent. Well, we have an opportunity for other folks to showcase some of their precommercial tech. I need to share my screen here. There we go. So a reminder, as I talked about at the beginning, at the meeting, we have issued a call for presenters. This is for the third meeting of the mitigation WorkStream. This will be on December 2. This is from 2:00 p.m. until 3:30 p.m. We are looking for folks who might have precommercial emerging technology. We are going to be looking at the same questions that we had answered today. This is around cost benefits and how to prioritize the technology on the system. It deals with how we get an understanding of the most cost-effective of technology going forward. Applications for this are due on October 30. To find out more, go to the website. Just maybe go there in a few minutes. You can see the pop-up button. Thank you again for joining us today. I really want to thank our presenters who have had an opportunity to discuss this. There were excellent questions for the panel here today. I really appreciate everybody's time. The next meeting will be on December 2. And, please look out tomorrow for a recap of this meeting, including

a recording and transcripts. There will be translation on the upper partnership website. If you have any questions about the policy and innovation coordination group, please reach out to me. You can email me. Thank you again for joining us today. We will see you next time.

Thank you.

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