Texas Produced Water Consortium Meeting

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SPEAKERS

Venki Uddameri, Laura Capper, Spencer Robnett, Keith McElroy, David Cooney, Ron, Charles Perry, Carter Copeland, Kay Tindle, Brent Halldorson, Zacariah Hildenbrand, Lawrence Schovanec, Steve Walden, Brent Hallordson, Danny Reible, jdealmeida, Marshall Watson, Eric Bernard

Kay Tindle 08:07

Thanks for joining us this afternoon. We're gonna wait a few more minutes before we get started. Okay, thank you again Hi, everyone, thanks for joining us this afternoon. We have over 50 participants who are in our meeting. We're gonna give others about a minute or two to join us. Thank you.

Marshall Watson 12:08

Well, it's straight up three o'clock or two o'clock, excuse me. Guess I'm speaking for those in eastern timezone. Hopefully, there's none. So I'd like to get everything kicked off. My name is Marshall Watson, and I'm a member of the Texas produce water consortium here at Texas Tech. And the first thing I'd like to do is, of course, welcome everybody here, and go quickly over the agenda. And soon as I'm finished with the agenda, I'll introduce Dr. Schovanec, which will give some opening remarks. So the agenda is first, of course, I'll introduce President Schovanec. He will introduce Senator Perry, who will give some remarks. And then later in my presentation, which is next on the FAQs, I'll introduce the rest of the team, and then go over a short overview of what sb 601 is all about what the purpose of this study, the next will engage the consortium. We'll start with a participant survey that's been prepared. And I'll talk about that at the end of the FAQs. And then we'll take considerations of of important questions. And in doing so, I'll give you a quick overview of the communication protocol when we start off that. And then of course, I'll wrap up by talking about planning for the next meeting. So without further ado, I'd like to introduce Dr. Lawrence Schovanec. Since he was named president in 2016, Texas Tech has seen a record level of enrollment and not judging from the number of students I see meandering around. Sure, we're going to break it again. It's also seen record levels of research expenditures as well as pivotal accomplishments reflecting the university's commitment to research outreach to the communities and industry. Texas Tech is one of 16 institution in the Carnegie, very high research activity classification that is also designated as a Hispanic serving institution. Additionally, since his appointment, Texas Tech has dedicated to start construction of new facilities that represent the best bet of more than $300 billion. And with that, doctors given a call, we'll turn it over to you.

Lawrence Schovanec 14:44
Thank you, Marshall. Your introduction will be longer than my comments here. By the way, you have a wonderful voice. He's like a radio personality. Thank you. To all of you. I'm going to say thank you for your interest in participation. In this produce water Consortium, town hall meeting. And I think we all recognize that none of this would have been possible without Senator Charles Perry. He is, has become a recognized expert on many issues related to water in this state. He is a lifelong West Texan. And I have a great respect and appreciation for senator Perry for the many ways he has impacted West Texas through his support. He was a major supporter of the Texas Tech School of Veterinary Medicine. And this issue here is just one more example of that. But I digress. I digress here a minute, though, because I want to share with you and in light of recent issues that have come up that relate to athletics, I think you've seen one of the wonderful attributes of Charles Perry. The conversations you have with him at a personal level, reflect what he does publicly, he is a person of his word, and not afraid to take risks that benefit our state, and especially West Texas, and this produced water consortium is a great example of that. We're very grateful here at Texas Tech that our institution will be allowed to have a leadership role in administrating the statewide collaborative collaborative effort. At Texas Tech, we try to conduct research that has an immediate impact to our community, the region in the state. So naturally, we're very involved in all aspects of energy, oil and gas in particular. But also agricultural sustainability of agriculture. And water is essential to that all of those elements are at play in terms of this produced water initiative. And so this is a natural fit for Texas Tech. It's very important in so many ways, and we're very pleased that we can play a role in this. And with that, I met monitor to introduce my state Senator Charles Perry.

Charles Perry 17:16
Thank you, Mr. President, and those kind remarks. And I'll send you a check later. It's a privilege to get to serve. I'm excited about this, guys. And anybody that's heard me speak to what this Senate Bill 601 was intended to do, can rapper can can relay my passion and the importance of this, there's really only one thing we need in life to survive is water. I mean, you can do a lot of things, that we would not take joy in having to do it the hard way. But when it comes to actually sustainability of life itself. And then you add on the economic impacts of not having a agricultural sector or the ability to support commerce or pull commerce in from around this country. It's it's going to get back to do you have a sufficient water supply to support those gross growth opportunities. So water is the number one thing that I believe we don't have a sense of urgency about. I think that our country in general, is not dealing with future water supply issues across this nation. We've seen it play out on the western side of the country, West Texas, is dependent on a water supply for its oil and gas as well as its agricultural sector. And then you throw in the growth that's happening in non West Texas areas and their need for water. So it's been said that, you know, whiskeys for drinking waters for fighting. I think that you'll see more and more that in my lifetime. It's already kind of come up through the state legislature every session on how do we go and get someone else's water. So 601 deals with the potential new water supply in a stress that that it's actual, new untapped potential water source. You know, we're about 95%, dependent on rain. rain comes in it re kind of recycles back through through evaporation and starts all over. This is something that we're not actually tapping now for as a possible possible source. So 671 is meant to put to bed several questions that I've asked and have asked for over 10 years now in the legislature. This is something that came together with multiple stakeholder meetings for the last two years, multiple

conversations outside with industry groups for the last few years. And it's intended to put to bed some questions and the basic of the questions I hope that are answered out of the 601 initiative is one is there a technology available today are a corporate combination or coordination of existing technologies that we can take produced water for those that don't know it for every barrel of oil that's produced in the Permian Basin this week. It really only works where there's a large feedstock of water that comes up in most oil and gas fields don't have it but the Permian fits the bill. Well, there's a lot of future stratifications to still frack, if you will, for production. But about six barrels of water on average comes up with that one barrel of oil. Since 2009, it's estimated that's been close to 27 million acre feet, acre foot 325,000 gallons of water, foot across of an acre. So the abundance of produced water that comes out with what we're naturally already doing in our oil and gas production, has today been either reinjected, which has created some environmental issues, or evaporated through leaving it on top of the water. So what this bill is intended to do is that one determine can we actually take that produce water and use it or actually clean it up for use? beyond just the frack the industry, oil and gas industry has done well, with being able to use it for their own internal uses to put back into the fracking process? So we want to know, can we go farther and make it a potential portable use? If not, is there a beneficial use between words being used today in fracking operations, and to the possible source that would eliminate pressures on the offers and other River Basin systems we use? So one, is technology available to? Is it scalable? In other words, if we can actually get the water to a possible standard, can we distribute it in those areas and be specifically in the West Texas region? Either by virtue of och for storage and recovery, they back into an offshore system or put it into a river basin system? So is there a mechanism or distribution system that is available or could be available to where we could actually distribute a new source of water back to the user groups? And thirdly, it is one doable technology to scalable, and three, can we afford it? What is the cost of doing that? And what would be the cost recovery mechanism? So it's a very broad in yet very specific initiative that 601 hopes to accomplish. I have a very aggressive timeline, I want this report back by August 22. So that when we go into session of 23, that we can start making decisions or by virtue of entering questions, we may determine that one, it's not doable to it's not affordable, or three, it's not scalable. So we need to know as a state is this something that we can bank on a future water supply resource in the future. So that's the goals of 601, plain and simple. We have a whole lot of stakeholder buy in we have actually worked on the regulatory end of it, needing to have some regulatory changes to have this conversation, because prior to those regulatory framework changes that we got done in the last two sessions, this conversation would have been fruitful, because you get to determine all three things, things were needed, or could be done. But there was a regulatory barrier, so we've removed. This is going to take a lot of work on a lot of folks, Texas Tech is for lack of a official title, in my opinion, is the air traffic controller. They're going to take all of these stakeholder groups are going to take some of these technologies are existing. There got some engineers, some economic folks in place. So tech is going to try to take what's going on in the industry groups that's working well, what's going on the other groups may not know about, including environmental groups and things, we want to make sure that we're very transparent in this process, but 601 hopefully, we'll answer those three issues. And we can leave here knowing that Texas has a new water supply opportunity or it's not worth any more energy from the legislature's perspective or stakeholders. With that, I'ma leave it up to the experts to talk. That's my 10,000 foot view of what I hope to get out of it. I have all the comps in the world that we're going to get there. It's fun. This is big stuff. It's not sexy. People don't think about their water taps running dry. It's not something that politically you gain a lot of mileage on, but it's something I'm committed to addressing to make sure that West Texas and the

things we love about it, the wide open spaces and the provider of food, fiber and fuel for the rest of the countrycontinues and it won't be for lack of water if it doesn't. So thank you guys for participating.

Marshall Watson 24:33
Thank you, Senator Perry, for your remarks and as well as you present scoopneck So next I want to kind of set the stage by just giving you kind of a little cut a couple of boring slides which take specific language right out of SB 601. It was created during the 2021 legislative session. So the duties are number one is: To the economic beneficial use of fluid oil and gas waste, and technology needed for those uses. And after October of 2022, to the research and investigation goes, the consortium shall be directed by the members of the consortium. And the host University may disband the consortium if the university determines that the consortium does not have sufficient membership. Next slide. So the record requirements of SB 601 is that it will as Senator Perry just stated into August that we're going to produce this report that will include suggested changes to law to better enable benefice. This beneficial uses of fluid, oil and gas waste and I'll elaborate on these may produce water but specific language in the bill states fluid oil and gas waste, including specific changes designated defined and defined beneficial uses of fluid oil and gas waste outside of the oil and gas industry to suggest guidance for establishing fluid oil and gas waste permitting and testing standards. Three an economically feasible feasibility project pilot project for state participation and facility designated and operated to recycle fluid oil and gas waste and for an economic model for using fluid oil and gas weights in a way that economical and efficient and that protects public health and environment. So that is language straight out of 601. So the next slide is a little bit on the organization has set forth by sb 601. The first is that Texas Tech is going to house this organization. And it will be made up and coordinated with the various committees and councils as listed below the stakeholder Advisory Council government agency, technical steering committee and private entities that I'll elaborate on the next couple of slides. Next slide please. So first off, Texas Tech produce bought a consortium of at at here house at Texas Tech includes interim director of Kayla Tindle, which we are now interviewing a permanent director and that is underway. The TTU faculty and co director team is inclusive of Eric Barnard Christie Bratcher from Ag sciences, natural resources, the Business school, Brad Ewing and engineering myself, Venki Uddameri and Danny Reible. And the ones by Asterisk says by them Eric, myself and Venki are the CO directors. The others are the technical directors. Next slide. So this is again, language that SB 601 sets forth. We're going to provide the the staff and resources necessary for the consortium to meet the requirements. We're going to consult with the New Mexico produce water Research Consortium, which Danny robble and myself have been a party of since its inception back in January of 2020. And we have already reached out and had many discussions with them and they're more than willing to participate with us. Then we're going to solicit type just patient from all those entities listed below. And then coordinate all of that. Next slide please. So you can see in the diagram to the right there, that's going be the slide on figure on the next couple of slides showing you each of these entities and how it Texas Tech is going to coordinate them. First off is the stakeholder Advisory Council. These are people from oil and gas industry, ag industrial, environmental interest.Basically midstream companies, the people on the recycling operations, public water utilities, landowners and owners of groundwater rights, commercial water recyclers, and midstream water companies and anybody else that would be appropriate to be a part of the stakeholder Advisory Council. Next slide. Then the next would of course be the government agency Council. This of course would include tarp and agriculture, road commission of Texas and the other Texas agencies that you can see listed there below. Next slide. Then finally, the

technical steering committee which I just mentioned that this is a committee composed members appointed by the host University, which right now is course, Christie Bradsher, Danny rival and Brad Ewing that I'd mentioned before. Next slide. And then finally, Providence to entity stakeholders which are simply individual corporations or other nonprofit corporations. Next slide. So, a couple of facts of the agency Advisory Council on those universities shall collaborate to create a fee structure. So this simply means that to come up with a membership cost that will include both actual money and or equipment in lieu of money. Money paid by private entities for membership costs can only be go towards research and investigation conducted by the consortium. And except for state money appropriated on item C, the Korean consortium cannot receive any other state money. And finally, D the consortium makes up gifts and grants of money, equipment and other resources necessary to accomplish the duties under this subchapter. Again, this is straight out of SB 601. Next slide. So what does all this mean, basically, so the purpose is on that first statement is collaboratively collaboratively understand the potential and options for produce water to meet the growing water demand, and projected unmet water supply in Texas. And the goal is to collaboratively produce an excellent report to the legislature on options for policy, technical, and economic response impacts for text produced water in the state of Texas. Next slide. So what is this? What is the challenge here? So first off, we see enormous growth and population in the state of Texas, we all know that everybody across the country is moving to Texas. And then we Next we have to produce enough water to meet those challenges. This increased population, obviously, for drinking, ag uses and other things of that nature. And so the question remains is okay, what, who gets the water first? Next slide, then we need to look at the cost benefit ratios of, of what to do with this produce water? I mean, is it cost effective to clean this water up? And then next, is the legislative and regulatory? And of what do we what do we need to do? What barriers can we remove in order to be more effective and efficient in producing water, or clean water from produce water. And then, of course, kind of an overall over rotting umbrella over the whole thing is, you know, not just climate change, it's the effect on climate change on our crops, whether and how, or, or the things we're doing with this produced water going to affect climate change. So it's an overall reaching type of issue, their final and the final count. Next slide, please. So this kind of just shows of kind of a visual of really not much we can do about the population explosion and the need for that water. But we what we can look at is, again, the cost benefit ratios of cost, or techniques to clean that water up and the legislative issues that drive that cost and or barrier, create barriers. Next slide. So here's all just this is just to see this is not the end all be all this is why we're putting this consortium together is to solicit your ideas, members of the stakeholders in this consortium as to what our options are. And what's kind of shown in this graph here is that as you move if you look at the top the colors there we go from produce water directly from the well to various points of clean up until the end up on the far right hand side with clean water. So in that first level, there's there's mining there's industry there's reuse back in oil and gas. The next point would be to maybe utilize for road use and dust abatement. Next would be such crops such as non food crops, such as crops for livestock, maybe cotton, maybe corn from ethanol, then Moving over, you have livestock and wildlife. I told Eric to put crosshairs on the deer being that I'm a hunter, but maybe that wouldn't be very politically correct. But we can the next one would be course suburban usage, watering plants and household usage, of course, food crops there. And then the final. The ultimate holy grail would be, of course, portable water for human consumption. Next slide. So, with at this point, I'd like to turn it over to Eric, because he's going to be conducting a survey here, Eric, you want to take over from here?

Eric Bernard 35:47
Perfect. Thanks, Marshall. Thank you all for participating today. And for Senator Perry, kicking this thing off for us and having a big vision for us, as a citizen of Texas and industries that that operate in Texas. So if you'll get your cell phone out, you can click a picture over the top of this little survey form. And you can take this very quick survey, it'll only take a couple of minutes on your phone and and we'll have a little live interaction here. And I'll show you the results as we go. So you can use the QR code, or I guess you could you could put that URL in but the QR codes, easiest way to do it right off your phone. Just snap a picture of it, answer a few questions and we'll see kind of where we where we see things together. So you can all start to see what's coming in as you click through responses. Thank you for those that are participating. So it looks like with about half maybe of folks that have responded. Let's take about maybe one more minute of your time and let a few more folks finish up. All right, so let's just take a look at kind of where we stand as a group for a few minutes here and go through some results. So in the first question, current proven technology out there to for produced water to be a healthy potable use. It's about a 5050 split. But more folks say yes, then know, that we can get to potable that's great is produced, you know, water processing for potable water economically viable? answer to that is no, not at this time. But the overwhelming majority can it be achieved, potable water that is from produced water at a reasonable affordable price? Again, a little bit more of a split toward no on this, but there's a lot of optimism here, that's really positive. The idea is about scaling up for produced water seems like there's a lot of potential for that, based on our audience today. If we look at how produced water could be used in the state of Texas, and you could click as many of these boxes, as you know, you want to do looks like the majority of folks think that out here in this bar, that obviously raising it in oil and gas production would make some sense. You know that everything from electric, Jen, a few other ideas. Maybe for those of you that responded other right here in this inside the chat in zoom, maybe a send us some ideas about some other things that produced water could be used for in the chat itself. That would be great. In terms of thinking about how people that are on this call might like to help with, you know, topics that we're we have to deal with for the report coming up. Looks like we've got a couple of folks that are interested in economics, several in policy, technology, water, quantity, and quality issues, infrastructure. And then some other topics. Again, if, if you've got some ideas down here at the bottom, we've got some more details under this one, about things that you can help with. So regulatory issues, DSL, water quality, can unfold some more details in here: regulatory issues, DSL, industrial uses, ag water uses, etc. So we'll harvest all of these results for everyone that took this survey. And we'll bring those results back to everybody as we go. Looks like we're pretty split, but a little bit more favor toward mid morning or mid afternoon for meetings if we were going to meet together again, at some point, and obviously we will. And then the best days for meetings. Looks like in here, Tuesday, Wednesday, Thursday are the best days, and maybe not on Mondays and Fridays. So gives us a little bit of an idea about how we can you know really quickly learn something from you about what you think's possible, not possible, where you'd like to help out and help us to move forward. Thank you all very much for your time in response there. Any other thoughts that you all have about, you know, the process that we just went through or questions you can raise a hand inside or post something in the chat box?Looks like in the chat. We've got a few things that are hereabout aquifer recharge, treated produced water used on cropsand are for recharge.So I could slide that out. Looks like injection to aquifers, highway construction. Excellent. question that came up. Is there actually proven technology to transform produced water to potable water? Someone like to weigh in on that that has expertise in this area. Looks like the answer's yes, but it's cost prohibitive in the chat.

Zacariah Hildenbrand 44:56
Hello, everyone. Are we able to chime in here?

Eric Bernard 44:59
Yes, sir.

Zacariah Hildenbrand 45:00
How's everyone doing today?

Eric Bernard 45:02
Very well, thank you.

Zacariah Hildenbrand 45:04
Great. Um, yeah, with respect to treating produce water to a potable state. Really the cost prohibitive step is the desalination component. I mean, we can remove hydrocarbons kill the bacteria, remove the solids relatively cheaply, but it's removing the metals and permanently the salts that make it expensive and prohibitive.

Eric Bernard 45:30
Great, thank you very much.

Zacariah Hildenbrand 45:32
My pleasure.

Eric Bernard 45:38
And I'm sorry, somewhere behind about 88 screens, there's maybe the window is everybody's picture on it.

Danny Reible 45:45
So I did I could not see you was talking that killed the brand from University of Texas El Paso. Great, thank you.

Keith McElroy 46:02
Keith McCrory out here in College Station, Texas, kind of in regards to the potable water or produce water to potable water applications. Yes, it's very expensive. But I've sat on the EPA board for produced water out of Washington DC. And the ideas that EPA has on getting to that is it will more than most likely never happened mainly because of the concept, you can't actually get every constituent of everything out of produce water to allow it to be put on a potable water crop or especially in anything where there's human contact with it for the mouth, or what have you. But key aspect of it is if you want to try to do that, you're going to drive the price of produced water treatment 25 to $35 a barrel. And nobody's going to pay for that. So that's kind of where it's at. For from even six weeks ago, when I was talking with some folks at the EPA, in Region six out of Dallas in regards to some produce water applications that they were looking at for an agricultural aspect. The EPA Region six immediately

canceled the permit on that, because it's it's never gonna get political approval for that. So it's kind of on where I see it for now.

Zacariah Hildenbrand 47:35
So I just thought I'd add that comment on that particular sentiment is is absolutely true. And it really the genesis of it is the fact that we don't have, quote unquote, the analytical tools to characterize all of the constituents found in produce water. Fortunately, though, when it comes to the organic compounds, and these are the the hydrocarbons, any kind of additives that would be in that fluid, we have the measure of total organic carbon, which can serve as a surrogate measurement for all of the species cumulatively. So it's actually research that my colleague Kevin schug, and I are looking at which is can we establish a healthy to see value so that operators can use that and once they get below that level, then it's as safe potable water, as opposed to always searching for 1000s of different methods to screen for things that the parts per trillion or parts per quadrillion level. So I've heard that sentiment from various environmental groups and certainly from from regulators. But you know, the the scientific tools are there, we can better understand this and hopefully, we get the opportunity to do so through something like this consortium.

Keith McElroy 48:46
Yeah, very good. I can, I'm sure there's some other experts that are out there that will understand the produce water and so forth. Your your number one, your number one constituent that's in produced water, you'll never get rid of it at a very reasonable cost is anything that's biocidal that's in the water. And any biocides that are injected into your produce water already EPA registered as you can't put them in the environment because they're extremely toxic. Residual biocides is the number one key issue and produce water. It's it's everywhere. It's been injected in the wells, it's it's residual compounds are in the produce water fluid, no matter which treatment application you go through unless you go through the extremely, very expensive, but then the liability angling of putting that in anything that a human is going to put in your mouth is not a reasonable application. Also in any agricultural reuse that has been achieved, which there has been has been only allowed on non food crops.

Zacariah Hildenbrand 50:00
Yeah, yeah, no. So for example, cotton was mentioned, there's a burgeoning hemp industry that's that started in the state of Texas. So for example, that seems like the lowest hanging fruit where you can take this treated water and hit those crops with it. I think you're absolutely right. I? Well, I think ultimately the technologies will exist, and that and the economics of them are becoming more favorable by the day, I don't think we're ever going to get to a point where people are going to be drinking, produce water, and or, you know, watering food crops with this stuff. But there's plenty of other things in mind.

Keith McElroy 50:36
absolutely, absolutely, I mean, correct.

Eric Bernard 50:45

Thank you all for participating and sharing insights from from each of your perspectives. Looks like there's a few other questions here in the chat that maybe are arehelpful. Just pull this over. And, and let's just take a look at some that are here. Can you all see that chat box now? On the shared screen?

Brent Hallordson 51:10
Yes, we can.

Eric Bernard 51:11
Okay. So Senate Bill 601 does not define member. So the question is really what is a member, and then levels of membership? We haven't gotten into that. We do know that. Just in terms of the ways that Senate Bill 601 does describe things. If we back up here for a second. The bill lays out these particular groups, as part of what you know, that makes up the Texas produced water center as a whole. So the stakeholder Advisory Council, the government agency Advisory Council, and then the technical steering committee, and then private entities, or stakeholders, is the way we've kind of read into private entities. So then, when Marshall went through this, you know, kind of set up, I would say that everyone who's inside this bubble over here on the right hand side, ultimately could be a member of the produced water center. The questions about fee structure and other things. I think that that the idea for today is to just let people kind of figure out, you know, what Senate Bill 601 says, what it is that we've been tasked to do here at Texas Tech, how to bring people together. And then as we get our primary, you can think of them like an executive director, but a program director for the produce Water Center, or consortium onboard here. Then we'll get into to the details about how fee structures would be put in place. And then and then learn from you what you think is reasonable in that way. So that the goal for today is really to just let everyone kind of see what Senate bill six oh, one's like, how we structured things here at Texas Tech, so far, learn a little bit from all of you that are interested in participating as a member. So everyone on the call today, we would we would appreciate, you know, your continued support in this matter. So I don't know if that answers it fully. Maybe without the idea about, you know, levels of membership. We don't have that sorted yet. But we do know that the the membership will come from these groups. Laura offered that the produce water society meeting in Houston on September 8, and ninth is coming up. So some interesting things there about DSL and disposable pricing for high volume kind of operations. Thank you for sharing that. So the question here from Spencer about how will recommendations from the water consortium and Senate Bill 601 be used? What is in the RRC mandate to encourage treatment and beneficiary use? Under 3516? Spencer, can you elaborate on that for us for a second? Exactly what you're thinking there?

Spencer Robnett 54:07
Yeah, I'll try a little bit. And this might be a question for senator Perry, if he's still on the line. But it sounds like there are two tracks here, one from the produced water consortium and also a mandate from the legislature this year. That tells the Railroad Commission that this needs to be a priority as well. And I just didn't know how those two objectives would be aligned. And if the recommendations from this group ended up at the Railroad Commission someday I know there's a Railroad Commission representative in this group, but they're they're two separate legislative actions and I just kind of curious how they work together, if at all, and if they come together at the end of the day based on the recommendations from this group, or if the Railroad Commission will make their own rules as kind of a see fit. And if they're under a different timeline, then this group might be

Eric Bernard 54:54
great. Thank you very much, Spencer. So the the response to that is obviously the goal that that Senate Bill 601 has is that that the center here, or consortium group, sorry, works, you know, with those agencies, how well we can work together in the future, I think is is a to be determined. And so I'll let others that that are from Railroad Commission, maybe that are on this call speak to this a little bit. If there's someone on that would like to share, that'd be great about how you see it from inside your agency.

David Cooney 55:40
Hello, everyone. This is David Cooney from the Railroad Commission Office of General Counsel. The first thing I'll say is that the Railroad Commission will always do what the legislature directs it to do. And, frankly, I hadn't given a whole lot of thought to reconciling Senate Bill 601, with House Bill 3516. But I'm confident that we will make sure that all that the interests in both bills are served by our actions. I mean, I hate to be that general about it. But I think now at the beginning is, is the time to be general about it. And what I see for us, as the government agency, is to use the information developed through Senate Bill 601, to inform our actions under House Bill 3516.

Eric Bernard 56:33
Great, thank you very much for chime in. And we really appreciate your participation today. Thank you. So Carter talked about the use of produced water for electrical generation and re condensation, you know, appears, you know, to have merit also for in the saltwater disposal, let's see is captured as a revenue source, along with CO production of the concentrated brine. Sure, I think that those really, you know, kind of innovative uses of where and how that were, you know, laid out here, I don't think we necessarily know, you know, all of the places that, you know, the water could could land, but whoops, you know, there's, I think this kind of paints a pretty good picture about the things that we've heard already about where water might be used or reused along the way. And then, you know, if you just think about the gradients of things about, you know, Where, where, and how, we've heard some things today that this, you know, far right hand side is going to be pretty complicated to get at from a variety of different perspectives. But maybe, you know, where is it that in the rest of this kind of balance that Marshall kind of laid out for us about, they're trying to figure things out, important to see. So, Keith, thank you, if you've got the URL for that EPA produced water report. If you'll paste that in there, that would be great.

Brent Halldorson 58:08
Yeah, if I can briefly say one thing, my name is Brent Alderson, our company, Brent. Hello, I'm honored to be on the panel here. And I was part of a company that had treated to a freshwater standard back in the early days of the Barnett for a decade, we worked with Devin energy, back when everyone was fracking with fresh water. So we had to treat to a freshwater standard to meet the frack spec, before the companies were able to frack with salt water. So the game really changed. But we did build a lot of experience and know how right here in Texas over a decade. And what I'm really excited about is there's a number of companies that have built on that experience, and have been able to drive the cost down at the time we were doing it, it was around $2.50 a barrel, which for sounds very high, but our biggest cost was fuel gas. And we were buying gas at that time at eight or $9 1000. So obviously, that

price has come down considerably. But we still need to go a lot further if we're going to get it to where we can be

59:16
cost effective. So that's that's a big hurdle. But there are a number of companies out there there's one based right here in Frisco that is using waste heat to treat produce water and can take advantage of very low grade waste heat. There's also a company called Eureka up in Pennsylvania that still uses our original technology, but how they make it cost effective is they are harvesting a whole bunch of trace elements like lithium, calcium chloride, actually making pool grade salt, so making use of a lot of the the CO products in order to get the overall cost model to work. So I think we can take advantage of some of these lessons that have been learned from other jurisdictions to help inform our group as well, so that we're not relearning some things that others have spent years trying to learn.

Eric Bernard 1:00:14
Great, thank you very much appreciate it.

Carter Copeland 1:00:17
Yeah, this is Carter Copeland, I was a co founder of the Permian Basin, water and energy conference. And one of the things that we kept getting pushback on was the fact that there's just so much cost for heat and the energy cost of desalinization, and so forth. So we did a little review of Midwestern power plants, and found an overwhelming amount of waste heat that is put into rivers at extraordinary costs. Whereas essentially, in the Permian Basin, if you could take sufficient volumes of produced water concentrated down by evaporating it down to a higher brine dead so that you essentially can convert that waste heat to evaporation and get it more concentrated brine stream. But the key is to have a different business paradigm so that you're getting, essentially that final saltwater disposal in the form of evaporation versus downhole injection. I think we're gonna have to look at some externalities that are also out there in the world of water, to come up with more creative ideas here at some point.

Eric Bernard 1:01:37
Great, thank you very much.

Keith McElroy 1:01:41
Let's just keep my clients, he brought up a very interesting concept, because this has actually been a topic with some of us and some of the researcher fellow researchers over at Texas a&m here. If you can get down to some of these concentrated brines, especially in evaporating and heating technology, that brine now contains lithium. And that is becoming a very large topic of these brine waters, containing your precious metals, lithium, cobalt is etc. I've already received some waters from the new shell plays the big shell play out toward Pecos area in West Texas, very high in lithium. I mean, a lot of lithium. So produce water could be looked at for lithium production. I know Tesla, Tesla is going to be looking for lithium with this new battery plant that he's building outside of Austin, Texas. So that's another concept you might want to even look into produce water contains a lot of different types of metals that can be extracted out for possible future use. that's a that's a very big topic within a lot of inner circles of your larger oil gas company. So just another thought you might want to put into it.

Marshall Watson 1:03:02
Great. That's that's an excellent point. And I might add, in the New Mexico Consortium, there is a service company up in Pennsylvania that is doing just that. And they're producing a tremendous amount of lithium, relative to the overall production of lithium, the United States. It's, it's I don't remember the exact number. It's a year and a half ago, but it was something like 30%. It was huge.

Keith McElroy 1:03:30
Yeah, absolutely. And some of the production water that's coming out of the El Capitan region, those brined waters are saturated with lithium. So it's a very, very profitable application to look at xinyi by DirecTV stream, get your TV together.

Eric Bernard 1:03:50
Great. I don't know. So just to jump back into the chat for just a second. So highlighting one right here from Kay, about just membership question. So the idea of this, that we're developing the membership agreement is important. And also a nondisclosure agreement. We're looking at how New Mexico's group is structured those things. Obviously, there's going to be things that come before this group, that that have to you know, stay in the group until it's right for it to become public and transparent, as senator Perry has indicated, that's important. And so we're working through some of the ways in which we handle that and how we go about it. So thank you very much for for adding that in. Okay, appreciate it. Um, I think we've got a few things here that we've already covered. Anything else before we jump to the next set of things here?

Steve Walden 1:04:56
Yeah, this is Steve Walden. I don't know if you can hear me.

Eric Bernard 1:04:58
Yes, sir.

Steve Walden 1:05:00
So, I would build on a couple of things that Brent talked about a while ago, which was Eureka resources out in Pennsylvania, they've got a third party that Center for Sustainable shale development that has collected data out there. And they take their their waste stream as essentially distilled water. They dump they have a tpds or mpds permit that they discharge to the Susquehanna River. And the third party has collected samples and run full full suite clean water at plus, and also called the Safe Drinking Water Act plus type of analysis looking at even future regulated contaminants and found it was pretty doggone clean. And I think the basis of their economic model, as has been stated, has been the sale of these auxiliary products like lithium and other salts and other valuable materials that exists in the brines. So it can be done, it really comes down to people like this source consortium working out ways to optimize the collection of these byproducts, which pays for the treatment to where it is actually a potable supply. I have spent 43 years of my life in the potable water supply industry, versus a regulator at TCU and their predecessors. And now for the last 18 years as a consultant to potable water industry. And we've already been doing this and the potable side, or white, domestic wastewater, which has trace pharmaceuticals, etc, in it. And we don't test all day, every day for those things, we come up with class treatments. So if we that's essentially what would happen is you have class of constituent

treatment processes. And then you prove it up with real detailed analytics to prove that you are getting those things out. But it would only be economic, if you were selling enough byproducts and make it pay for itself. And I believe we have brines in Texas that will allow this to happen. And that we will be successful to produce potable supply as a result of these bi products and the improvements and analytics that was doctors Hildebrand was talking about. So that's how we're going to get their improvement. And I wouldn't be saying that if I didn't think it was possible, because they're already, essentially one or inch away from that already doing it in Pennsylvania, which has, you know, more TDs water than we do. So I just can't wait to the consortium to get going. Thanks. Thank you for weighing in. That's really helpful. I think, you know, when you when you look back at the data from today, and how people have kind of seen it or or perceived of it.

Eric Bernard 1:07:21
It seems like you know, that we've got a lot to learn, as a community of people. One of the important things I think, you know, in in respect of your time and just kind of moving forward here, we've thought about, and I'm sorry, I don't know how how I drew on the screen. If there's a little red lines there, I apologize. I don't I don't think I did that. I think somebody else might have marked it up, but we'll figure it out. One of the things that we think is important is, as we start to move forward as a consortium, what are some of the key questions that are out there that you've got? And then a first one for us is, if you've got some thoughts on the ways in which we might divide or subdivide? Are you know that we've got over 100 people on the call today, and we really appreciate your time. Thank you very much. How is it that we take on this this really, this really big task that the legislature is put in front of us through senator variants in Senate Bill 601? How do we deliver this report in a year, you know that that is a pretty daunting task. If you've got some ideas about ways that that we might think about organizing a set of, you know, subcommittees or groups to study individual pieces and parts. We've thought about that a fair amount, at this point, have some ideas, but we'd like to learn from you about some things that you think might be helpful in terms of the ways that we could work together most effectively. There's a second question, you know, that's out here. We'll just put a couple out here that we think are important, you know, what are what are some of the barriers and opportunities for economic viability of produced water? in Texas? Another question would be like, how would policy be shaped to ensure the safe equitable use of produced water in Texas because you can think about about the the amount of water that's out there. Just the back of the envelope calculation, if you just look at it produced water from last year, we're talking about somewhere over around a fifth of the total potable water supply that's stored in reservoirs in the state of Texas, all the reservoirs that are used for drinking water. That's what we had in produced water last year on a gallon basis, gallon per gallon basis. So we're talking about an extraordinary amount of water that's here, but how is it safe? And then how is it equitable in terms of use, there's there's lots of different ways that we could use it from industry perspectives, you know, through you know, all kinds of land use, land cover treatments, etc. So, there's two questions that that we've kind of thought about. And then the last one, that's an important one that we'd like to learn some more things from you today, in the last 30 minutes that we've got here are what are your key questions? What are the what are the questions that you think we should be asking? Or we should be working on that then however, we, you know, we break down this this task into these different groups, and work with you to help us solve this problem. And produce this report within a year? What what are those questions and feel? maybe think about those, you can type them up and then copy and stick them in the chat box? That would be fantastic. Marshall, do you want to add anything right here?

Marshall Watson 1:10:44
No, just that. Just echoing what you said that we certainly are down the road is for figuring out, you know, because we do have a nice roadmap that what New Mexico's already done. And we certainly don't want to recreate the wheel there. And or change anything unless it's not working? Right. If it ain't broke, don't fix it. Right. So I think we're a ways down the road there. So what we do need is obviously input into Texas, as far as mostly, you know, what kind of legal barriers such as the the one where legislation was passed not too long ago to enable us to utilize, produce water to frack with and remove a lot of legal issues surrounding the ownership of produce water. So, you know, we're looking not just at technology, but we're certainly looking for legislation that would encourage any of the conversion of this produce water to useful means.

Eric Bernard 1:11:57
Great, thank you, Marshall. And if if somebody wants to just share a question, you know, with us, that you think we ought to be really paying some attention to early on as we're getting ramped up here, or thought about how you've seen some teams like this work together, some of you are probably participants in the New Mexico group. Maybe you could comment on what's worked well there or, or things that you think maybe we could try that that are a little different, like Marshall said, if it if the if that kind of a model seems like it works well, we spent some time looking at that one pretty carefully at this point. Do we have any thoughts on questions or ways to work together? offer some thoughts on that.

jdealmeida 1:12:46
And everybody hear me?

Eric Bernard 1:12:47
Yes, sir.

jdealmeida 1:12:48
Okay . And I have been very active with the Mexico border contortion as the consortium there, Ruffalo, one of the things that was formed that forwards the recent past few months to cannabis to evaluate technologies, claiming to be able to effectively deliver on water that would be fit for purpose. So there were many solid, solid quotes on panels panels that we're able to take apart, if you will, in a professional peer review way, these proposals to try to ascertain what might work what might not work, and what absolutely will not work. And I think, I think when when we as the Texas group, if you think about the the stature of a 601 it's not called a technical committee is a technical and economic steering committee, something to that fact. It's not the question isn't, is the technology available? It is available? that's never been the question. The problem is, is it economically viable? And the panels that we'll put together to review all the proposals that I did look at both the economic and technical viability, and that may be something the technical organization will look at. It will be there will be many promises. I'll have heard some comments. For example, have you picked up a question that Pennsylvania as an example, operators here information will say, Well, what produce water is $10 a barrel? In Pennsylvania? Yes, you can make many different processes word to disposal . So just share.

Eric Bernard 1:15:04

Great, thank you, I think it broke up in and out a little bit here and there. But I think we got an awful lot of of what you had to offer, about, you know, the differences in costs from one region of the US to another. And then what the opportunities might be economically, are also different based on those things. Thank you, for those that have, you know, put some things in the chat, I see some things from Kevin. Sure. And if I pronounced your name wrong, I apologize. And then, let's see Leonard, Keith, Bill, and Carter Copeland, thank you for offering what you have. Let people take a look at what they've put in the box there.

Marshall Watson 1:16:02
Bill was echoing basically what I was saying, you know, now we start producing these valuable minerals, who owns them?

Eric Bernard 1:16:11
Yeah, I think that those are the kinds of questions from a policy perspective, or that are going to be interesting to, you know, sort out how the lease agreements have been put in place before and and, you know, it's it's a little bit of a web to untangle. That's for certain.

Marshall Watson 1:16:28
David, obviously, and I had this discussion with Carter last week. I mean, you know, one thought is, is that we have to create the infrastructure to both gather all the produce water, and then the infrastructure to disseminate it. Not, obviously, not just the cleaned up water, but what are you going to do with the concentrated water, the minerals, etc. So there's got to be some policy there to help on clearing the way to move those materials from point A to point B.

Eric Bernard 1:17:12
Indeed.

Brent Hallordson 1:17:17
Yeah, I agree with that. And the reality, the new water midstream industry has invested hundreds of millions of dollars in water pipe in the ground in the Permian, over the last five plus years, to address that very issue, which is what makes this really exciting to me. So I've lived in Texas since the early 2000s, East Texas, has plenty of water. West Texas has no water. But we've got the oil and gas and the Permian Basin is such a gem of an asset out in West Texas. So having the water midstream infrastructure now in place, and the cost coming down. I'm just really excited for the state to be looking at this as hard as they are at this time. Because I think a lot of the issues that were preventing us from doing anything at scale, even five years ago, are starting to fall down now to where we have the ability to move large volumes. We've got plenty of gas and waste heat, as has been said, people are being successful at mining the trace elements. I mean, you've put all that together and you start to to actually build an attractive case to where I think Texas can be a world leader, especially in the Permian Basin. I mean, it's such a wonderful, you know, real gem in our, us energy portfolio, it's our best asset. And water has been the biggest issue. So like I said, I I know I'm preaching to the choir here, but I think it's exciting that there's been so many advances in the infrastructure piece in the mining the minerals in the treatment. So I look forward to seeing what happens. And again, as has been said, New Mexico has

done some great work. So I think we can leverage some of the things that the New Mexico group has learned to help jumpstart the Texas effort.

Eric Bernard 1:19:16
Great, thank you. Looks like there's a couple of questions in there about just data. And we talked with New Mexico last week about some things that they're working on right now. Some of that is even in partnership with groups in Texas. There's a lot of fantastic data that's out there, like Bureau of Economic geology, has some great resources Railroad Commission, obviously he's got resources, there's, there's private vendors that have data too, that are out there. One of the things that we'll have to deal with, as part of what we do here, too is is work out how we collaborate with the data and how we make that available and open. When when at all possible. So where are we have some places where we're missing data, or where we could do a better job of collecting or disseminating, I think that those are important questions for us to start to get our, our, our minds around as well, for those that are interested or have interested in that, in that particular topic. We have not necessarily had that on our list today. But it is one that's in Senate Bill 601, about the way that the data will be handled, and then shared back out to the public. So there's a little detail there, but but not a lot. And then there's a lot of different groups that already have really fantastic data that are working on things like said in the state, and then Mexico for certain. Let's see, the idea about a policy requirement for mapping of infrastructure. You know, the dig test system, that's, that's a pretty interesting, you know, kind of set of things. Railroad Commission, I think, you know, has has a tremendous kind of mapping platform that's got a lot of data in it, how and where some of these other kind of infrastructure elements are in exist, I don't know how much of that is in or not in at this point. I've seen some, some maps that that have this in it, some 3d models that have this kind of data in it at this point. But they're not widely available to everyone, I don't think, at least that I've seen so far. But I could be very, very wrong about that. And I'd love to learn from you about, you know, where it is or isn't, and what we can do to make it better. The idea about waste heat. You know, I think mapping some of these things and understanding, you know, what, where the possibilities and potentials are.Again, it's like stringing together some data sets that maybe haven't been put together at this point. But we can definitely work on those things. That's that's part of what what we've been tasked to do. If you've got ideas about, about data resources, again, you can drop those in the chat or send us a message at any, any time. We've got just a few minutes, you know, left here. Looks like Laura has chimed in about some larger issues with DSL. And the concentrated salts dream as a whole. Let me take a look at that one. Thanks, Keith, for posting that. Produce water matrix report up.I think Keith also posted another link for us earlier to consideras well. Thank you. We'll try to make sure that we collect these notes and and pull them all together.

Venki Uddameri 1:23:04
Eric, real quick. This is Venki Uddameri. There were a lot of questions in our directories, a lot of interest about aquifer storage and recovery of produce waters. I wanted to see if there was any experience in this audience with regards to implementing that or trying to what what some of the regulatory barriers were, in many states, you have to bring it to potable water standards to inject water into ground. So you know, some discussion there would be useful that I think Senator Perry mentioned that as an alternative as well. Soit's wondering if you could spend a few minutes looking at that.

Eric Bernard 1:23:48

for sure. Are there folks on the call that- and by the way, Dr. Uddameri is is one of the CO directors so Marshall and he and I are the three co directors here at Texas Tech and then Danny rivals who who is on and also Christy Bratcher is on and Brad Ewing as well, are the team that's kind of been working to get the sense that consortium kind of up and going on this end and we'd really appreciate everyone's input so far- So does anyone have any experience in the ideas of aquifer, you know, kind of recovery reuse?

Ron 1:24:34
Yeah. Eric, I think you're gonna have to at least meet the existing water quality in the operator, or exceed its its level of purity to be able to inject.

Steve Walden 1:24:50
This is Steve Walden and I was I worked for 28 years in the TCK safe drinking water I program and that's what the Safe Drinking Water Act requires basically is where you're going to inject to a microphone that's portable source under 10,000 TDs water, then it's going to have to be a non degradation situation, basically. And that's where it gets back down to some of the analytical issues to determine is have we confirmed that we've got that covered back to what Zach was talking about? Well, I go in, so I think we can get there. We're not there right now, but we can get there.

Marshall Watson 1:25:23
Right, this is similar to New Mexico allowing produce water cleaned up produce water to be put back in the Pecos. River. Right before it enters Texas.

Eric Bernard 1:25:35
That's pretty curious, you know, in some of the conversations with the folks from over there, you know, where that, that water reenters, the Pecos River system also has an impact on on its quality as well, picking up additional salts as it moves forward. So there's also some a lot of other environmental questions that are out there, too, about where and how and what's the right kind of place to to, to do any kind of reintroduction. So looks like something just popped in there from El fleet. About UIC. That's a federally delegated program. And then Royal Commission and TCQ,applying to EPA to request, you know, that substantial revision,

1:26:26
great.

Eric Bernard 1:26:32
There's an awful lot of things to connect here aren't there? It seems like the more I learn every day, the more I figure out that that there's a lot, there's there's a lot of optimism, there's a fair amount of pessimism about how far you can go and what's really possible or not possible. And then ultimately, you know, again, how it's both safe. And equitable, I think is a really important set of questions for the future Texans. That will be you know, dealing with this water at some point beyond our lifetimes of the folks on this call. So important kinds of things to think, think about and move forward. So you know, that there's maybe additional things that you have that you'd like to offer up this email address, txPWC@ttu.edu, we'll get to all of us at Texas Tech that are involved, so that we can put into the chat

box here, as well. And you can copy and paste that. That email address, like I said, should get to any of us here at Texas Tech that is, so if you've got additional ideas and those kinds of things, we'd love to hear them. A final kind of question really, for the group is, you know, given the fact that we've got a year to produce this report, and we need to kind of get some things kind of organized, we've got obviously some legal things, we've got to get sorted on this. And Senator Perry has been great about helping get this thing, you know, kind of set up and going, we at the University are chomping at the bit for the money to land here. So we can hire some additional folks, we've been interviewing, as well. So as of September one, we can officially start, you know, doing a lot more things with people that are getting getting paid to do them. And so that's really helpful. And we're thankful for that support very much. And just excited to have have folks coming on board to help help organize. So as we move forward. A question I think exists about how often so we have an idea about kind of times of day. And also some things about days of the week that are best seems like midweek meeting, either mid morning, or mid afternoon is best for folks in the survey, and obviously we're not going to be able to hit everybody. How, how often are you meeting on on these kinds of things, either with the New Mexico group, if you're serving in any capacity there? Or how often do you think that we ought to be getting together seems like at least a once a month kind of town hall like this one where we kind of report back on where things are would be important. But that might not be fast enough to kind of move through what we've got to it and a report that's doing in a year. So we just like to hear from you a little bit about how often you've met or what kinds of expectations that you might have to help us communicate effectively and accomplish the task at hand in a year.

Brent Hallordson 1:29:51
You know what New Mexico did is they formed subcommittees to look at different bite size areas. And then I think the subcommittee's generally meet Every two weeks. And then the overall group, if somebody can correct me, I'm not even sure is that every maybe every other month, it feels like they're having a call for the entire group. But I know the subcommittee's meet every two weeks seemed like there was a quarterly statement or a quarterly report or a quarterly meeting that they talked to us about as well. Yeah, that sounds right. For the entire group, and then the subcommittee's present what they've done over the last quarter.

Eric Bernard 1:30:38
Great, or thanks for sharing that.

Laura Capper 1:30:42
One, one comment learning from New Mexico, you may want to play around with different meeting options. It's, as far as I know, we really never got it perfected in New Mexico where they could send out meeting notices, and it would show up in our calendars real reliably. So just being able to get us something that we can all get in our calendar is very, very helpful to get these things set up.

Eric Bernard 1:31:06
Fantastic. One of the thoughts that that we have as an institution, I mean, to just to share documents and other things as well. And to have some ease at doing that. We use Microsoft Teams a fair amount in house. And there's a variety of different options in that platform for how it is that we could share meeting times and things like that that can show up in your calendar easily. I don't I don't know if that's

a platform that that people are using on the call today. That's at least one option that we have. Zoom is nice for things like this. But the hard part is, is that we can't necessarily share documents that easily. It's like you're emailing a bunch of things around rather than just having a repository where we could share things. And then obviously, the web page that will that we're working on now will have an awful lot of content on it as well.Does anyone have thoughts about, you know, platforms that that you've used that have helped you organize and manage things?

Steve Walden 1:32:05
Yeah, this is Steve Wald. And we I'm on a national, a WWE, a committee of several different types, actually, and every one of those committees is easy as it done evaluation of what to use and evolve. They're all now using Microsoft Teams very successfully, to kind of keep it all bundled together. And that's that's the only platform I know about. But I'm sure there's others.

Eric Bernard 1:32:26
Great, thank you for that input. Carter, that that idea about a data clearing, you know, subcommittee, you bet, we will add that to the to the list. Looks like you know, on this end, we're going to work, you know, really quickly to finish up the hiring process, and get our program director on board. And then, you know, work hard to get that person kind of up to speed as quickly as possible. We'll try to capture meeting notes from today, summarize those things, and then send that you know, or package that up. And maybe we'll just start to stand this up in teams, and then add everyone that's in today into the team's environment, and then start to share notes that way, that way, everybody can kind of see the running track record of things. I think at this point, I'm going to hand it back over to Marshall. And let him get started. Or sorry, finish up. Yeah.

Marshall Watson 1:33:39
Don't make me start all over again. No. First off. I wanted to thank everybody for participating today. I think there's a great crowd. I think we had up to 115 or so participants today. The next order of business is when is our next meeting. We don't have a specific date yet. But I do think it will be sometime in the month of September. So we'll take a look at course the feedback we got on the particular days thatmost wanted to have it on and we'll get those out. relatively soon. All of you think there is Eric, do we have any particular methodology to coordinate getting everybody signed up? So basically, at least have a so called mailing list.

Kay Tindle 1:34:34
This is ok we have a list of everyone who has received the meeting invitation whether directly from myself or forwarded on from a colleague. So we're making sure that we're keeping a running contactless on our team site.

Marshall Watson 1:34:54
Thank you. Okay, appreciate that. So hopefully, if you don't think you're on the list, or somehow you don't hear anything. Please feel free to communicate with us on that email that's posted for you, I think, on the page there at tsp wc@tcu.edu. And we'll make sure that you are on that list. Eric, that's all I have. And just again, a big thanks to all of you that participated today and Senator Perry for

spearheading this and making it happen. And of course, US President scoopneck for his wisdom and guidance and in our university.

Eric Bernard 1:35:39
Indeed, thank you all very much for your time and and enjoy the extra seven minutes. We're giving you back today and we'll be back in touch soon. Thank you very much. Appreciate it. Have a good day.

Marshall Watson 1:35:51
Bye bye.