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Transcript

Using AI Well — and Building a Data Infrastructure to Support It
March 6, 2026

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Published March 16, 2026

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Welcome and Keynote: Professor Harry Surden

https://youtu.be/YFXyfM33K8A

[00:00:00.08] MATT SCHMIT: Right. Well, good morning. Welcome to CU Law, and the home of the Silicon Flatirons Center for Law, Technology and Entrepreneurship. I'm Matt Schmit, the new Executive Director here at Silicon Flatirons. And I must confess, today is the day I've been looking forward to since day one. It's a little snowy outside, so we saw a shift in participation from in-person to Zoom. So we've got a lot of folks out there. Thanks for joining us virtually today.

[00:00:22.24] This morning we're going to hear a keynote remark, remarks from Professor Harry Surden on the conference theme of using AI well. We'll then enjoy two panel discussions on established use cases in AI, in emerging best practices in using AI well. You catch that theme this morning. We'll take a little break for lunch, and then we're going to reconvene this afternoon. And we're essentially doubling the content that we're providing you today.

[00:00:46.76] We're going to examine an essential and informal formula of sorts by AI's meteoric rise, namely various demand and supply side factors, building a data infrastructure for the future. I'm really excited for this, and for this morning's event as well. Now, the afternoon panels will explore new terrain for Silicon Flatirons, an area we have not gone before. And we hope you're going to enjoy the full day of insight and exploration.

[00:01:13.77] But now, before we launch into today, I want to give a quick thank you to our great staff, Shannon and Christine. Nate and Sarah. Thank you so much for making today possible. And also, thank you to all the students who make the day run so smoothly. Let's give them around of applause, and thank you.

[00:01:29.85] All right, folks didn't come to listen to me talk. And so, without further ado, I'd like to introduce a man who really needs no introduction here at CU, the Hatfield professor of Law at the Silicon Flatirons, our AI initiative director. And also, importantly for today's conversation, former software engineer, Professor Harry Surden. Join me in welcoming Professor Surden.

[00:01:55.17] HARRY SURDEN: Thank you, Matt, for that kind introduction. And thank you for all of you for being here on this slightly snowy day. Although Coloradans wouldn't consider this snowy. I want to also echo my thanks to the amazing Silicon Flatirons team, Shannon Sturgeon, Christine McCloskey, Sarah Mariotti and Matt Schmit. Amazing team, as always. Also, to the students again who worked incredibly hard, the CU Law faculty, and Dean who were extremely supportive of this.

[00:02:29.73] Our expert panelists, who have traveled far and wide, and all of you for joining us, either in person or virtually. So let me tell you what I'm going to talk about today. Today, I'm going to help you think critically about predictions about AI. So one of my research areas is studying predictions about technology, and where they succeed and where they fail.

[00:02:51.83] And the punchline is, they almost always fail. So I'm going to give you a critical tool set for thinking about when you see a prediction about AI, whether good or bad, how to evaluate it for its credibility based on past research. So I'm going to start out giving an overview of AI three years in to the modern large language model revolution that started with ChatGPT in late 2022. What's happened since then?

[00:03:22.12] Then we're going to see that there's a lot of anxiety and hope about AI, all the changes that are happening in society. Then we're going to focus on the predictions themselves. What is reliable about technology predictions? What is unreliable? And there are principles for telling the difference.

[00:03:38.72] Then we're going to use some examples to see how several predictions about technology and labor they we're very confident failed spectacularly, and we're going to analyze the principles and why. And then finally, we're going to talk about the way forward. How can we nudge AI in a positive direction?

[00:03:59.39] A pro-social direction that helps bring us to the future we all want. So let's just start with an overview. Where are we today in artificial intelligence? So as Matt said, I was a former professional software engineer. I've been doing this for a long time, and I've been studying AI and law for 20 years. For the first 17 of those years, my message was AI is interesting, but it's not a big deal broadly speaking.

[00:04:27.83] The last three years, I have said, things have changed. Things have changed dramatically. AI is now a general purpose, increasing technology that's advancing like we haven't seen before. So things have changed. I was very much critical of the limits in the past, and then based upon evidence, the last three or so years, I've changed.

[00:04:49.99] So what the big moment that we all knew about was the release ChatGPT 3.5, in late November 2022, followed quickly by GPT-4 in March of 2023. So about three years ago. And what surprised the world also surprised researchers the vast majority of researchers did not expect in. I did not expect such an exponential leap in capability.

[00:05:16.57] We thought it was going to be a slow, steady creep. And maybe the possibilities we see today we would get maybe in 2030. So this is the theme. We're not good at prediction. But what's happened in the last three years? So we've seen a shift from models. These are AI models, particularly text prediction models that used to, by and large,

produce one word at a time instantaneously, to composite models. Models that spend some time thinking, reasoning before they answer, leading to better performance and verification on knowledge tasks.

[00:05:58.36] And also, the models are able to use external tools, tools like calculators, web search, and a variety of programming tools. So this has been a big change. Last year, if you were here at this very time, we had a conference where we said in 2025, the big thing is going to be agents. And we were right, because agents have taken over in the last year.

[00:06:22.64] Any if you talk to anybody in the tech world is using AI, almost all of them are using various coding agents, whether it's Cloud Code or a variety of systems out there, that where the system does some sort of semi-autonomous on its own planning and drafting in response to that user input. So that's really interesting. So that's changed.

[00:06:48.44] We've seen steady improvements in performance in the AI systems over the last three years. So for those who aren't familiar, one way we measure performance in the AI field is something called a benchmark. And in most cases, it's just a series of hard problems with known answers that we feed to AI models. And then we check how many of them they got correct.

[00:07:11.77] And we've seen really important increases from the early models in 2023, when many of these models were getting 5%, 10% of the answers correct, to today, where most of those models are saturated, which means almost every current model, whether open source or proprietary, gets all of them correct. So what they're having to do is create harder benchmarks. The old, easier benchmarks are no longer good.

[00:07:39.79] Now, as I'll talk about, this does not mean that AI is perfect. It's what they call jagged intelligence, which means it's really smart in some areas and not very smart in other areas, in really unpredictable ways that you can only figure out by using it repeatedly. And it still suffers from problems, occasional, although decreasing, of hallucination and inaccuracy. So users have to be really careful still when trusting AI outputs for major decisions.

[00:08:11.67] But one of my areas of research is, how does AI work on intensive knowledge tasks? So these aren't really captured by the benchmark. So things like law, medicine, thinking. And roughly speaking, there are in my estimation, they're increasing about 10% compounding each year. So if in 2023 it became 10% better, in 2024 at a hard problem in law or math, solving more of abstract problems than it couldn't the next year, it was 10% on top of that. So slow, steady improvement. But steady. You'll hear a lot of things about AI hitting a wall. I am seeing no evidence of that at all.

[00:08:58.36] The ecosystem. We've seen the rise of the open source models, many of them from China. Some of them are competitive with the frontier models, and even the ones that aren't neck and neck with the frontier proprietary models like Claude from Anthropic, ChatGPT from OpenAI, and Gemini from Google are just a few months behind, which is interesting.

[00:09:23.68] We're seeing the economics shift dramatically. So for the same level of performance in 2023, say GPT-4, which is the state of the art, it's 1/100 roughly today. For that same level of performance, we're seeing costs go down dramatically. That doesn't mean that AI costs less, because people are expecting higher performance and paying for the more capable models. But for some use cases, good enough is fine.

[00:09:56.93] So looking ahead, performance progress has been steady and increasing. I don't see any sign of it slowing down, but this is the important part. That does not mean we can predict what that means for society, for politics, the job market, for labor. What I'm going to show you in this talk is those predictions are notoriously unreliable, and I'm going to draw some distinctions, even if we do think the general predictions about AI improvements themselves are reliable.

[00:10:32.93] So where are we in the current moment? So you're hearing a lot of excitement from some quarters. AI is going to lead to a world of abundance. Some people say, we won't need jobs because AI will fill all our wants and needs. That's the extreme optimism abundance view. On the other hand, we have extreme, pessimistic and negative view. AI is going to eliminate job. There will be no more jobs, deep uncertainty about the future. So we're in this moment where some are very excited.

[00:11:08.15] There's a lot of anxiousness, and I want to acknowledge that this is a time what we know is definitely going on. There's a lot of change going on, and jobs are changing, but we don't know what the impact that will be in any detailed way. But things are happening.

[00:11:27.05] I think there's a lot of the anxiety we're seeing, anger about data centers for some quarters, are a manifestation of the general anxiety people are feeling about technological change. And this is a common phenomenon whenever there is an emerging technology, whether it be electricity or radio or telephone, something that's diffusing through society.

[00:11:49.30] There's generally social dislocation because people are uncomfortable with change, and it sometimes has hard consequences on people's lives, which we want to acknowledge. So there's a lot of justified anxiety out there. So what I want to do is equip you guys with a toolset for wading through that uncertainty, making good critical distinctions.

[00:12:14.62] So on the one hand, nary a day goes by where, depending on how your social media feed is tuned towards you, what you're maybe getting optimistic predictions coming in. AI is going to solve all disease within 10 years, says Demis Hassabis, winner of the Nobel Prize. Jamie Dimon, CEO, says, here's what's going to happen. I'm predicting this. Your children are going to live to 100. There's going to be no cancer, and they're going to have three day workweeks, right. Well, he's a big business leader. So maybe we should believe him.

[00:12:54.03] On the other side, we see the other business leaders saying the exact opposite, doom and gloom. Bill Gates says all job, all knowledge jobs, are going away. Dario Amodei says, it's going to wipe out half of all entry white collar jobs, et cetera. Even Bernie Sanders, long time AI researcher, is getting into-- no. [LAUGHTER] Is getting into the claim here.

[00:13:21.45] Hundreds million jobs are going to be wiped out. So what should we believe? We're hearing two different stories, extreme optimism or extreme pessimism. So I can't give you the answer, but the best I can do is tell you how a researcher like me approaches this. This is how we critically analyze a question like that. And research suggests skepticism about all predictions, but especially the most extreme predictions.

[00:13:48.79] And in part, and this is the important part, no matter how confidently these predictions are stated and no matter who states them. And I'll show you why in a second. But people they don't say in a passive voice. This may or may not happen often. Hundreds million jobs will be wiped out or we will have lives of leisure, I guarantee it.

[00:14:12.33] There's very little room in between. And often these are leading lights. Bill Gates, in one of the most successful business persons of all time. Jamie Dimon, famous CEO. Demis Hassabis, head of Google DeepMind. Surely these people know. And I'm going to show you no they don't know, for various reasons. Nobody has a crystal ball because they're making predictions in fundamentally unpredictable areas.

[00:14:40.42] And research shows, when we go back, there are predictions by people just like them in unpredictable areas, are unreliable. So what does a researcher do to make sense of this? Well, the best you can do is systematically go and look at historically, have we had moments like this, a big technological change? Were people making confident predictions with people of authority, and how well do those predictions come out, generally speaking? And the answer is terribly.

[00:15:16.32] Almost all of their predictions came out wrong in moments like this. Because, as we will see, what they're trying to predict is fundamentally unpredictable with any level of uncertainty.

So, so in this talk, I will not give you certainty, because in fact, I will give you the opposite. I will promise uncertainty.

[00:15:39.71] So this is not a future about the talk of AI, but what this is going to give you is a toolset, a toolset for you maybe to sleep better at night when, in your social media feed or in the New York times, an article comes out predicting some extreme future of technology, either positive or negative, and why. We're importantly, we're going to look at the principles underlying this and I'm hoping this will reduce a lot of this anxiety that people have, because a lot of anxiety is projected into an unknown future.

[00:16:15.47] We certainly have anxiety about what is going on today, but a certain amount of anxiety is the unknown, what could or could not happen. And we often just defer to Voices of authority because they seem like they know what they're doing, and they talk very confidently. OK, so the first principle is there are two very different types of predictions. If you go back and look at their literature, some of which are reliable and some of which are unreliable. So what we're going to try and do is disentangle those. And I want you to try and observe them out in the wild.

[00:16:51.67] So on the one hand, predictions about technological trends based upon data can be reliable in ways that I will talk about. What is unreliable is, what are the outcomes of those trends if they come true on society, on politics, on jobs, on institutions. Extremely unreliable, and many confident predictions conflate the two. So let's take a closer look at this. So it is definitely possible to make informed predictions about trends in technology. And indeed, scientists and engineers do this all the time.

[00:17:31.70] But what predictions? These are only certain types of predictions are reliable. First of all, the time frame has to be narrow. The most reliable time frame is one to three years. You sometimes see people projecting out confidently 10, 20, 50 years. Those types of long term projections are notoriously unreliable. So take those with a grain of salt. But you can see short term projections. And what projections?

[00:18:02.06] So what's the hallmark of such a trend? It's either grounded in current and past data, grounded in engineering constraints and principles, grounded in current research that exists today or physical facts about the world. So if you look at the hallmark of current projections, take something like Moore's law, which some of you might know about. And this was a rule about microprocessors.

[00:18:29.83] That said, roughly the number of transistors in microprocessors in the past were doubled every 18 months. It's more or less says that. So that seems, how can you make that prediction? Well, you go around and you look at the underlying data about current microprocessor practices. What's the current research that is guiding

us. And then reasonably you can predict out within a margin of error, out into the world.

[00:19:02.25] A similar thing is happening with graphical processing units. These are the chips that are used in AI. So AI uses a different type of chip that was originally for gaming. You've probably heard of NVIDIA, big company that's made a lot of money. Similar type of thing is going on. You can project out certain trends. Again, these are not perfect, but they're reliable in the sense that their database, and they're not. They may go this way, they may go that way, but it's a reasonable trend.

[00:19:36.63] What people mistake is they conflate the technological trends with the impacts of those trends on society. If CPUs were to double in processing power in five years, or AI performance would increase by 10%, what does this mean for society, jobs, politics, social institutions? Those are ridiculously unreliable.

[00:20:01.11] And I'm going to give you examples. But the fundamental principle is, the outcome of those depend on dynamics, complex systems, economic markets, psychology, nation states, social institutions, all these things that are far too complex for a simple technological trend to predict. And what's worse is, there are pure unpredictabilities. So there might be a new technological invention on the horizon that we can't predict in energy or in computing. So there are things we can't even imagine.

[00:20:42.94] So the world is simply too complex to make any confident predictions about AI and its effect on society. OK, but here's the pattern I want to cue for you. Be on the lookout for this in the media. So you'll have somebody like Dario Amodei or Demis Hassabis saying, I'm an expert in technology. And here's a trend I'm seeing. AI is getting better and better at this rate. So good that that's reliable.

[00:21:14.20] They're taking a highly reliable trend, but then they have an overly simplistic model of the way the world works, and it's not really their area. Demis Hassabis is not a labor economist. Jamie Dimon is not a cancer researcher. So they have an overly simplistic view of some other area of law or other area of society. And they say, therefore, this is what is going to happen in society. And that's overly simplistic deductive prediction, either positive or negative.

[00:21:45.77] So let me just give you some concrete examples and what we can learn from this. So even economists aren't immune from this. So John Maynard Keynes, one of the greatest economists of the 20th century, famously and boldly in 1930, wrote an article called On the economic possibilities of our Grandchildren. So what did he see? He said, look, in the Western world, what we're seeing is roughly 2% economic growth per year, compounding due to technology.

[00:22:20.61] There's lots of technological innovations that happen and continue to happen. So he said, look, let us project that out into

the year 2030, where we are now. And by that time, economic gross domestic product and standard of living will have increased hugely by then. We can produce our wants and needs with much less resources. That was correct. All that happened.

[00:22:49.57] So he had a strong economic trend driven by technology that he was right about. What he got wrong was his conclusion. He said, therefore, this is what will happen in society. We will all work 15 hour work weeks. Society in 2030 will be primarily one of leisure. All our wants and needs will be met, and things will be distributed evenly.

[00:23:19.33] So what was the mistake he made? He was right about the trend, but he had overly simplistic model about what increased productivity does on society. He assumed that all that extra production would go immediately be substituted into leisure. But that's not what happened of course. And then the gains would be equally distributed. But as people got more money, their standard of living went up.

[00:23:45.36] If $1,000 in 1930s could buy your food and your rent, then now many of us have that today. But we also need an iPhone and a computer and things like that. So psychologists call this hedonic adaptation, right. Along with our increased general wealth came increased wants and needs and new wants and needs that didn't even exist back then.

[00:24:10.78] So this is not to critique John Maynard Keynes. It's just to show you an example of an optimistic prediction error. We had a well-defined trend, and then an unjustified, confident assumption about how that will play out in society. Let's look at a pessimistic prediction. Another equally eminent person. So this is Geoffrey Hinton. He won the Nobel Prize in physics. He's widely regarded as one of the godfathers of deep learning that led to our modern AI revolution.

[00:24:45.19] Somebody I really respect from a technological level. But what did he do? So in 2016, AI was getting good enough that AI tumor detection systems were better than radiologists at the time, at detecting tumors. And he was quite right about that. If you just did a pure technological match, the AI systems were better at detecting tumors than radiologists.

[00:25:14.31] But then he made a confident prediction. By 2025, radiologists will go away. Why? Because we don't need them anymore. But by 2026, the exact opposite has happened. Radiologists are in demand more than ever. Their pay has gone up, et cetera. So what went wrong? Well, he had an overly simplistic model of the way the world works.

[00:25:45.59] And again, we're going to break it down. But this is the same pattern of error. He took a real technological trend. AI is getting better and better at spotting tumors. He said, therefore, I'm going to apply an unrealistic set of assumptions about the world and draw an

unconfident, confident conclusion in an area where I haven't studied the complexities, which is labor economics.

[00:26:10.51] So if he had spoken to-- so he's a very smart guy, but he's not a labor economist. But I speak and work with labor economists, and these are people who study the impacts of technology on jobs. And it turns out it's much more complex than our simplistic model. So if a lot of these procrastinators, procrastinators would have spoken with people who study this, they might have come to a different conclusion.

[00:26:36.74] So we're going to diagnose, so to speak, what went wrong with this prediction. Because I think it's really illustrative and will arm us with tools for analyzing such predictions about AI in the economy. So what a labor economists say? One of the biggest problems that people do is they confuse a task with the job. So economists see a job like a radiologist or a bank teller or a lawyer as a bundle of tasks, especially knowledge work.

[00:27:09.64] So a radiologist is not just a tumor spotter, right? Is a bundle of tasks, including diagnostic patient communication, analysis of the disease, interaction with other doctors, et cetera, et cetera. So one of the most major problems that people do in conducting this analysis, and this is what Geoffrey Hinton did, was they have an overly simplistic mental model or view of what a job is. So they think what's the radiologists do?

[00:27:44.91] Well, the first thing that comes to mind is they spot tumors, right? So therefore, if technology is getting better at that, therefore that job is going away. But in fact, that is just one task among many. So we saw the same fallacy play out with ATMs. So ATMs came out in the 1980s, and there was predictions of widespread unemployment among bank tellers by the late public. Why? Because we had an overly simplistic view of what bank tellers do. What do they do?

[00:28:17.73] Well, they give you money. That's what they do. But that's turns out that's not what they do. Again, it's a bundle of tasks, including loan management, and customer management and all sorts of other valuable tasks. So instead of employment going down for bank tellers, the exact opposite happened. Bank tellers spent less time giving money to customers and could devote their time to other economically valuable tasks in their bundle of tasks.

[00:28:44.45] And that's a very common thing. We've seen this with lawyers. Junior associates used to spend a lot of time doing manual document review during litigation, looking at emails. This was substituted with electronic discovery. There were widespread predictions of unemployment of junior lawyers. But of course, that's not what happened.

[00:29:06.53] Why? Because a lawyer is a bundle of tasks. And if technology frees you from one task, and there is an economically

valuable substitute where you can be shifted. That's going to be productive using your skills. Your job doesn't go away, it just shifts. And that's what happens. So that's the problem. Task diffusion.

[00:29:29.88] So another simple model we do is the mistake we made in Geoffrey Hinton made is the simple substitution model. So in our heads, we think, a lot of us think a human does this task. A technology comes and does it to either almost as good or as good. Therefore, that task goes away. That's called the simple substitution model.

[00:29:55.64] In a small number of jobs, that is true when the task is completely replaced by the technology. So think how ditch diggers in 1900s were replaced by steam shovels and manual mathematicians used to do manual calculations in the 1930s, and 40s were replaced by computers. But that's not usually or necessarily what happens.

[00:30:20.43] People forget that technology can complement. Often, technology is a tool which enhances knowledge workers. They can use the output of the tool to be even better than they were before. So this is what many believe happened to radiologists. It's not that the AI came in and took over the tumor spotting and put them out of jobs. In fact, it complemented. It augmented their ability to make diagnosis. It became a tool to allow them to increase their quality of diagnosis and treatment care.

[00:30:55.39] And this is a very common thing that has happened in the history of technology, particularly in law as well. We see a tool such as Westlaw and LexisNexis electronic research. There's a prediction that the task will be substituted away and it will lead to less demand. In fact, it makes the lawyers more productive at their job because they can do they can use it as an augmenting or complementary tool.

[00:31:20.37] So that's problem number two Geoffrey Hinton made. He used the simple substitution model. It's not always true or not usually true, that the technology replaces the human task. Often it complements and augments their ability as they use it as a tool. So there's some nuance there. Another issue, too, is if Geoffrey Hinton had talked to labor economists, they would have told him told you about Jevons paradox.

[00:31:47.27] So this was a paradox first observed in the 1800s, where engines became much more efficient. They used coal. So people predicted this would lead to a decline in coal because your engines need less of it. But in fact, the exact opposite happened. It led to more coal. Why? Because in some cases, and it's hard to predict, declining costs leads to increased demand.

[00:32:13.08] So a lot of models think the coal model thought, well, say, we have 100 people who are demanding coal, and now we have more efficient models. We'll still have 100 people demanding coal, but we'll need less of it. That's not what happened. As the cost went down, it went from not 100 people, but to 1,000 or 100,000 people. So the

demand often will increase. It's not static, which actually offsets other losses and capabilities.

[00:32:42.58] So you might think, wow, AI is automating contract analysis by 90%. That's not true. I'm just giving an example there. So you might naively assume we need 1/10 the lawyers, right? But not necessarily true because of Jevons paradox. As cost goes down, there might be huge amounts of pent up demand that are released when cost goes down.

[00:33:08.03] So the same mistake that could happen with computer programmers where just in the last eight months, computer AI coding has gotten really good. I've been testing AI coding for three years and went from not that good to really good. It's very good at this point. So a lot of people have said, well, therefore don't send your kid to study computer science. All coders are going to be laid off. Not necessarily true. It's just too complex to predict.

[00:33:35.79] Many times we've seen Jevons paradox. If the cost of software goes down dramatically, there's all this pent up demand for software at a low price, which could actually lead to increased employment for software engineers. Same thing could happen in law. So not that will happen. It's just what labor economists will tell you. That's a dynamic that the simple model doesn't capture. And it could happen and often does happen.

[00:34:02.01] Another error that's made is something called the lump of labor fallacy. So in 1900, 40% of Americans were employed in agriculture. And then along came the mechanization, mechanization of agriculture. And the simple substitution model said, wow, we only need 2%. So 38% of jobs are going away, and 38% of Americans will therefore be unemployed. But that's called the lump of labor fallacy, which assumes that the amount of labor is fixed. And when automation comes in, job categories disappear forever. But the economy is dynamic.

[00:34:39.91] So what happens actually is, while it is true, people get displaced and we shouldn't dismiss that. When technology individuals, get displaced and they may not be able to be retrained in the short term. But that's different from saying jobs will disappear in the economy, which is what you hear people saying today about AI.

[00:34:58.91] In fact, the economy created huge numbers of new jobs that didn't exist at all in 1900. So today only 2% of Americans are employed in agriculture. But we have a whole bunch of new jobs, data scientists, computer scientists, what have you. That didn't even exist. So be skeptical of the claims that jobs generally will go away. I think probably jobs will change in ways that we can't predict. But we shouldn't forget the well-worn lump of labor fallacy. Just because existing jobs go away doesn't mean that jobs generally go away.

[00:35:42.68] OK. So yeah, so this is the example I was talking about where now 38% of Americans are not unemployed. Rather, the new generation were trained for new jobs and new industries which the economy created, we can't guarantee that will happen. But again, as a researcher, you look back and you say, where was our thinking flawed and what actually happened, and what lessons can we learn about it.

[00:36:10.25] Another question is timing and diffusion. So it's really hard to know how technologies will diffuse in the economy. So on the one hand, AI does seem to be diffusing quite quickly in some respects, in certain quarters. In other aspects, slower. But there's a difference between how quickly a technology diffuses in society and how and when its impacts are felt really broadly and strongly in the labor market.

[00:36:43.09] It was estimated that it took 20 years or 40 years for electricity, the benefits of electricity, to reveal in their productivity numbers, because organizations had to revamp their processes and their factories around electricity. We saw the same thing in computing in the 80s and 90s, where it took a Solow's paradox, if people are familiar in the 1980s, he said, the computing revolution is everywhere except in the productivity statistics. And that's because there was a huge lag. It took a long time and it was incremental. This may or may not happen in AI, but it's just something to flag.

[00:37:20.43] Electronic research in law started in the 1970s, but it didn't make real headway until about the year 2000 or so. And then finally, and this is the most important, jobs and employment are affected by many, many other things besides technology. In fact, technology is not even close to the most important thing. By far the most important thing that affects jobs and employment is the economic cycle.

[00:37:47.81] Whether we're in a recession or the economy is doing well, that's the dominant force that affects things. But there is other things like global supply and demand, and politics and tariffs and changing demographics. The mistake is to think, here's a technological trend. Therefore, this will be the most important and dominant effect on employment.

[00:38:13.34] So that's another mistake that Geoffrey Hinton and a lot of these prognosticators could have made had they talked to labor economists, who would say, technology is a factor. But you're oversimplifying, you're assuming it's going to be the dominant factor that is going to shape things, and that is not how the world works. There are all these different factors come into play and really unpredictable ways.

[00:38:40.92] So also watch for incentives. So just recently this happened last week. A startup called Block said we are laying off 4,000 people. Why? Because of AI. But was that really true? Well, a lot of

people have expressed skepticism, which is this person had it. So the alternative message was, we made bad business decisions, or business is doing badly and we overhired and we messed up. Or they could say, hey, this new productivity tool, which is making our business really great, is coming.

[00:39:11.99] So that's what we're doing now. So be skeptical of the motives here. What an economist would tell you, we actually won't know. The best and only reliable way is to look at the data. And probably we won't know for two years out, in the aggregate, whether AI is affecting employment. And even then we have to isolate it in hard to detect ways from other factors like the business cycle.

[00:39:39.45] Similarly, media claims. The media have an incentive to serve you extreme predictions, positive or negative. So even reliable sources about the facts, like the New York Times, which I'm a big fan of doesn't have a crystal ball to know the future. But that doesn't stop them from routinely putting either extremely positive or negative predictions about the future of technology. And very rarely do they go back and say, we made these extreme predictions in 2010, and boy, were we wrong. That was irresponsible of us.

[00:40:16.39] There's a difference between reporting about the here and now, and reporting about the unpredictable future. One is just much less reliable than the other. OK, so what can we expect? So I promised, certainty. So we don't know. But what we do know is, yes, technological trends like I do cause disruptions, and we shouldn't dismiss that at all. And I'm not saying that jobs will change the way we work. Society has changed. We just can't predict the details of how that will happen. I don't know if that's more reassuring or less reassuring.

[00:40:58.36] On the other hand, in general technological prediction, technological revolutions, while leading to a lot of short term instability, have generally led to more jobs, higher employment, and higher productivity. That may or that's not necessarily going to happen here with AI, but it should. It should at least be a framework to consider. OK, so here's the toolset I've given you.

[00:41:27.72] When you see a prediction, be skeptical about technology predictions. Figure out, first of all, are they predicting what the trend is? What is that prediction based on? Is it based upon data or just their intuition? But we've seen the trend somewhere between 1 to three years out can be reliable. And are they predicting the impact of that trend on society, which is unreliable? Or are they making a prediction about what will happen with jobs, what will happen with political institutions?

[00:41:59.59] What will happen with foreign politics? What will happen with sociology or human psychology? Very unreliable. So you can be skeptical and say, they don't know. I want to empower you to say, I don't care if they have the Nobel Prize or they're a professor, they

don't know. For the fundamental reason is that nobody knows. It's too complex and predictable, and the only informed decision is not to make confident predictions.

[00:42:26.37] So what can you do? Does that mean everyone's guess is as good as everyone else? No, actually, there are well established ways of planning for environments of uncertainty. So the way people study this, think about this as view this as a menu of possible futures and plan for some of which are positive, most of which are neutral and some of which are negative.

[00:42:49.13] And that's what policymakers should be doing, right? Rather than listening to people confidently predicting the positive or negative, the best way to do it is plan for a range of futures, recognizing that some of those futures are even ones we can't even predict. So you might plan for 10 futures, some of which are AI is enhancing productivity, some of which AI is leading to catastrophic, many of which are neutral, and then five more, which we can't anticipate because maybe a new technology like fusion or something like that or comes along.

[00:43:25.31] The most important thing, though, is to collect evidence, measure what is actually happening. And the governments do a good job of this. They say, software jobs being replaced? Are lawyer jobs being replaced? But it takes time. Unfortunately, the best you can do is wait and see what happens, collect enough data, and try and disentangle the effects of technology from other effects like the economy and globalization, et cetera.

[00:43:57.78] So in past changes, there's no guarantee here. But in past changes, 2% of jobs have been like the ditch diggers or the elevator operators who used to push the buttons on elevators. Completely eliminated. About 30% of jobs, actually saw decrease in demand and were disrupted. And about 70% of jobs were either neutral or actually had increased demand.

[00:44:24.98] So if it's anything like the past, the most likely thing will be more positive than negative. But there's no guarantees, of course, because there are definitely meaningful differences in AI compared to past trends. It deals with knowledge work. It's happening faster than ever. It's a more general purpose technology.

[00:44:47.45] So what we need is adaptation. We need our institutions to measure, collect evidence, and adapt when they see evidence. But what they should be doing is being skeptical of predictions, confident predictions made without evidence. So that brings us to our conclusion here. How do we nudge AI in a positive direction?

[00:45:09.15] That's what this conference is about. It's not that you might think we can't do anything. It couldn't be further from the truth. We can do a lot in fact, studying history, there are well worn, well worn

institutional governance structures and ways that we can nudge society towards a pro-social future.

[00:45:29.07] We can't guarantee it, but we can do active things now to make it more likely that positive things happen in the way that we want, that the benefits are more widely shared, that we take care of different communities. We take care of the environment. We focus on human community flourishing and thriving. We apply AI to specific problems of today. And that's what we're going to talk about today on our panels.

[00:45:59.61] We're going to see how are we able either to apply AI to improve specific known problems of today to make things better. And our first panel will be talking about that with trust and safety. And more broadly, we'll see how in later panels, how governance structures and institutional norms can push us in this positive direction. Because I definitely the history shows us we can definitely do this. So without further ado, let me turn it over to our next panel with moderator David Sullivan. So please join me up here, and thank you very much.

Panel 1: Established Use Cases in Using AI Well

https://youtu.be/3e2nu6XGd5Y

[00:00:00.44] LUCAS BEDNAREK: All right. As a Prof. Surden said, I'm Lucas Bednarek, I'm a first year student here at Colorado Law, and it's my pleasure to introduce our established use case panel today, beginning with David Sullivan, our moderator, who is the Executive Director at the Digital Trust and Safety Partnership, Becky Foley, Vice President Trust and Safety at Tripadvisor, Melissa Stroebel, Vice President of Business Development and Strategic Impact at Thorn, and Dave Willner, who's Co-Founder of Zentropi Incorporated. So, without further ado, join me in welcoming our established use case panel.

[00:00:42.86] [APPLAUSE]

[00:00:46.62] DAVID SULLIVAN: Thanks, Lucas. Thanks, everybody for making it here through the snow and weather today to join us or joining us online. So I'm David Sullivan. I direct the Digital Trust and Safety Partnership, which I'll speak about briefly, but more importantly, I have the pleasure of being on the advisory board at Silicon Flatirons, and it's always a pleasure to be here, both with the incredible speakers that Silicon Flatirons brings to these events, as well as the audience, which always asks incredible questions. So we're looking forward to your questions towards the end of this panel.

[00:01:20.00] You have the names and titles of our speakers. I am just incredibly pleased to be bringing this group together. We have an incredibly seasoned panel of folks who've been doing this work for a long time, have risen through the ranks from the front lines, and I'm just looking forward to learning from. So for this panel, this really dates back to a conversation that Harry and I had in the fall when I learned about the theme for this event, the idea of using AI well.

[00:01:52.20] And I said, actually, I think that what we in the industry of digital products and services call trust and safety, is actually one of the best examples of this, notwithstanding the fact that every day you read about a dozen different examples of horrible things that are going on in the world in terms of online content and behavior, oftentimes supplemented or amplified or in some way aided by trust and safety. But in fact, and those are all very real problems we're going to talk about, we're going to probably going to touch on some challenging issues, just as a warning.

[00:02:29.53] But nonetheless, AI sort of coming out of the world of automation and use of technology to address challenges around user-generated content is something that's been used by teams inside companies for decades. How that's being used and how it's changing is something that really quite dramatically has shifted much in the way

that the broader AI conversation has shifted. And I'm really looking forward to talking about that with this group.

[00:02:59.81] Before we open it up to the panel, I just did want to say, so at the Digital Trust and Safety Partnership, which I have the pleasure of running, we bring together companies who provide all different types of digital products and services, from very large platforms like Meta and Microsoft to a small AI chatbot startup and a internet infrastructure company around best practices in this space.

[00:03:26.19] And the idea is that rather than trying to standardize what type of content or behavior should be allowed across all the many different services that make up the internet, we can instead try to organize and align and standardize and mature the practices that companies use to address whatever it is, the thing that they don't want on their service, from things that are universally unwanted and illegal, like child sexual material, to things that might be more particular to specific platforms, like fake reviews on a service like Tripadvisor.

[00:04:02.86] So we do that. We've developed an international standard, which I've got a couple hard copies of with me today, called the safe framework, that sets out a framework of those practices. And we've been thinking a lot about the use of AI in this space. And two years ago, in 2024, we convened a working group of our members to look at best practices around the use of AI in trust and safety, looking both at established use cases as well as what the possibilities were for using generative AI as part of things like content moderation and trust and safety more broadly.

[00:04:41.90] At the time, we came up with about 30 use cases, 11 different challenges, 11 best practices that could respond to those challenges I think another 11 or 10 considerations for future use and a few different ideas for how to move forward. We tried not to make bold, wild predictions of the kind that Harry just talked about, but I think a lot of what we identified two years ago has borne out, except that even then, even talking to companies who are ones involved in frontier models, there was still, I think, an enormous amount of caution about, yes, maybe AI can help us here and there, but also we have all of these other considerations that maybe make us cautious about deploying it.

[00:05:30.96] That has changed dramatically. I think we'll talk more about how that has changed dramatically in this panel. So I think oftentimes when you may hear about AI and the world of online content and conduct, it will either be in relation to those bold announcements and predictions from CEOs saying that AI is going to take care of all of this without giving much nuance to that or through incidents, either of harmful things that you read about, including a lot of AI used for non-consensual intimate imagery, or AI-generated child sexual abuse imagery, those kinds of issues.

[00:06:17.83] Or you hear about this in the context of issues that put this into the spotlight, like, for example, when during the COVID lockdown pandemic, companies were basically not able to deploy the content moderators that were bringing them into the office in different places around the world, so AI took over. That didn't go great at the moment. But these things are, I think, not giving the full picture of what this is all about, and that's what we want to try to do in this discussion today.

[00:06:48.63] So as I mentioned, we have some of the best in the world at this. And bringing together perspectives from a nonprofit organization that both does research and builds tools, Thorn, somebody working inside one of largest travel platforms, thinking about these issues in a way that you might not ordinarily think about the kind of issues that are in the world of online safety, and then somebody who's started a company to try to use generative AI to solve some of the problems that have perennially plagued challenges around how to do moderation and classification of content at scale having done it from the beginning across several different companies. We'll talk about all about that.

[00:07:35.49] But I want to start really with understanding the landscape here and starting with some of the most challenging issues. So I'm going to start with Melissa from Thorn. Melissa, so Thorn, and I would love for you to explain to folks what Thorn is and what you guys do better than I can, but you both are a non-profit organization dedicated to helping children stay safe online. And you do that both through conducting really path-breaking research, but also building and deploying tools for the detection and investigation of child sexual abuse imagery and other sort of child sexual exploitation issues, which, again, is some of the most difficult and challenging material that there is that everyone is contending with in this space.

[00:08:25.04] So what are you seeing in terms of the research side, and what are you guys doing about it in terms of the tools?

[00:08:31.64] MELISSA STROEBEL: Yeah, and very excited to be with you all today on this very snowy morning. It was a long drive from Evergreen today, but very grateful for four-wheel drive. David, thank you for the description of Thorn. Pretty much caps it up wonderfully. We are a nonprofit that builds technology to combat child sexual exploitation in the digital age. Now, I want to back up just a little bit to set the stage, because while we focus really on that lens of combating child sexual exploitation in the digital age, it didn't start in the digital age.

[00:09:08.46] And that's a really important thing for us to always keep in mind, because, yes, technology is changing it, but it didn't inherently create this problem, and it will persist through all the subsequent technical innovations that happen, unfortunately. We have to ground ourselves in that human behavior piece of it and thinking how

technology is either being weaponized by those individuals or how it can be deployed by those on the front lines who are combating this issue.

[00:09:39.84] So zooming back before the internet, a lot of us just assumed that our kids were safe if they were home, under our roof, in a protected space. Curfew hits, kids come home. We don't have to worry about it. At that point in time, the biggest risk was somebody who had direct access to the child, a parent, a coach, a trusted member of the community. Now, that is still the case. The predominant amount of hands-on sexual exploitation of minors is perpetrated by those in their communities, the trusted adults. But technology changed it because now cameras came along and we could memorialize that exploitation.

[00:10:22.85] And then the internet came along and it was much easier to share those images. Child sexual abuse material, or CSAM as we shorten it to, could spread much more quickly. Interesting little tidbit. Does anybody want to guess what the leading investigative agency was combating child sexual exploitation in the '90s and early 2000? It might surprise you. In the back?

[00:10:54.53] AUDIENCE: [INAUDIBLE]

[00:11:02.09] MELISSA STROEBEL: So you might be thinking of the National Center for Missing and Exploited Children, who is the national clearing house for reports. But actually, the federal agency was the US Postal Inspection Service, because before the internet, the way that these images were most often shared was either directly handed off or through the Postal Service. Now, USPS continues to be part of the ecosystem combating these crimes, but now there's so many more agencies involved, because it became easier to share the pictures, and then it became easier to meet others who had experienced exploiting kids and could give them security tips and could encourage them.

[00:11:40.33] Then it became easier to meet potential victims online. And now it's even easier using AI to create the images themselves. Now, again, I didn't create this problem and AI is going to be part of the solution, but it is an important component. When I was working back at the National Center for Missing and Exploited Children, my job was reviewing these images, back in the early 2000's. And at that point, NCMEC was receiving about 100,000 images, or 100,000 reports of online sexual exploitation a year.

[00:12:14.14] Last year, they reported receiving over 20 million reports, and those reports contained more than 60 million files that needed to be reviewed by humans oftentimes. And we have seen over the last two decades the ways that technology came into the equation for those teams reviewing these images to help us get through that massive pile that much faster. Now, in addition to the research that we do at Thorn, because what we need to understand is how the human beings are experiencing these risks, we survey young people every

year to hear from them to understand what they're seeing, what they're worried about, and how it impacts them.

[00:12:56.46] We're surveying trust and safety professionals. We're surveying law enforcement. And again, what we hear is the human behaviors persist and technology is making it go faster. It's making it easier. It's confusing the issue because we don't always know, are we looking at an image that took place offline, or is that an image that was the result of an AI generative model? But now technology is starting to help with that process. It is being deployed on the front lines, and we use our research to help build the technology in service of combating these issues at scale.

[00:13:35.30] So one of our primary products we provide to industry, to platforms so that they can detect child sexual exploitation and be reporting it at scale. So now, not only are they able to recognize images that we have previously seen, and I don't want to get too into the technical weeds, I think maybe Dave might do that for us.

[00:13:58.21] DAVE WILLNER: Love weeds.

[00:13:58.97] MELISSA STROEBEL: Love weeds. Perfect. But then on top of it, with classifiers, with machine learning, we're now able to recognize images that we've never seen before. And that offers two things, two really critical things. When you think about that volume of content, I want to put a little bit of scale on the numbers of people whose job it is every day to find those kids in those images. When I was doing this work, there were 10 of us at that team that was responsible for reviewing that content. Now trust and safety teams are increasingly part of the equation.

[00:14:33.97] But you look globally at the law enforcement teams specialized in these cases, we have fewer than 1,000 investigators around the globe who specialize in finding the kids in these images. So when you have 63 million images and fewer than 1,000 people, if we are not fully leveraging the abilities of technology to shrink the haystack for them to find the kids in immediate danger so they can focus there, then we're falling behind.

[00:15:08.75] DAVID SULLIVAN: Thanks for situating us there, Melissa. So I want to turn to Becky, and I want to, I think, help broaden from maybe one of the most dire and difficult of topics that comes up in this space to shift the focus a little bit. I think probably, hopefully, most of us are not dealing with the kinds of issues that Melissa just described in our daily lives. I know I personally, when it comes to travel, which is one of my passions, spend a lot of time using Tripadvisor and thinking about some of the issues that may not be thought of as in the same zone when it comes to trust and safety and content moderation, but which nonetheless provide both AI challenges and AI opportunities.

[00:16:03.34] And that's the kind of work that Becky leads at Tripadvisor, looking at what kind of policies and what kind of content

should be allowed, how to prevent fraud and fake reviews, and also keeping people safe who are actually out there in the world traveling. So, Becky, what does AI look like for you and how is it changing the work that you do?

[00:16:26.76] BECKY FOLEY: Sure. Well, thanks so much for having me here today. The commute was interesting especially. I'm originally from Florida, so I don't drive in the snow very often, but I made it. So yeah, I'm Becky Foley. I lead trust and safety for the Tripadvisor Group, and that means I'm responsible for the policies and enforcement around traveler safety on and off platform. And, David, you mentioned that trust and safety professionals for a long time have met AI with a level of caution, and that's absolutely true.

[00:17:04.82] In my career, there have been many third parties, vendors, that have come to me and said, I have AI that will solve all of your problems, we are going to be able to detect inappropriate content and allow you to scale in ways that you've never imagined. And so, OK, great, let's test it out. And dozens of tests over the years, not one single time led to an increase in our ability to detect inappropriate content at scale in a way that we wanted to for a platform like Tripadvisor, because you have to understand that every single user-generated content platform has a different set of policies and things that they enforce.

[00:17:52.16] So Tripadvisor has what I would consider a more stringent policy on the type of text that we allow because of the way our product is built. Our product is publicly available to all users. You don't need to follow a specific user. You don't need to be friends with them. There's not text or images that are operating in the shadows. Everything that happens on Tripadvisor and Viator platforms is publicly available. So our content policies are a little bit more stringent, and we also don't get the same types of content that maybe big tech platforms get, like a Meta, et cetera.

[00:18:33.53] So back to we did several different tests with many AI vendors. None of them were successful. And then here we are a couple of years ago, generative AI comes on the scene. And again, we're always happy to test new technology and see the results that we might get. And so very first thing we started to test out was our policies around hate speech. You can imagine in the travel business, we're in the business of bringing people together.

[00:19:04.37] And when we bring people together across different cultures, different political views, different backgrounds, a side effect of that is discriminatory speech, hate speech and being able to balance that with what would typically violate our guidelines, our policies with what we want to be able to include because it might depict a cultural difference, can be very complex. So we tested our first model based on hate speech and discrimination, and we found it to be 99.2% accurate

against our policies. So that is more accurate than the humans that we had historically reviewing that content.

[00:19:50.09] But even more important, more accurate in identifying it right at the point of submission versus it getting posted, impacting a business owner, impacting other users of our site, being able to capture and differentiate between the policy abiding types of texts and images and those violations. So we were able to deploy generative AI towards our text moderation. We're now automating 99.7% of all text moderation across the site, with a 8% increase in identifying that text right at submission when it was inappropriate.

[00:20:35.66] One of the most important things and the biggest value add that actually happened very recently is that Tripadvisor, as I said, we're not a platform that people necessarily use to operate in the shadows. So in proportion to the amount of content, billions of reviews and opinions that we get, the number of terrorist threats, the number of CSAM submissions that we get is minuscule. So it's not that it never happens, it's just that it's a very small portion of what does happen. But that means historically, we spent a lot of resource aimed at problems that weren't at scale for us and weren't necessarily solving issues for our travelers.

[00:21:20.24] But of course, it's something that we ethically and morally needed to identify. But to be honest, we weren't always necessarily the best at it and definitely not the fastest. But now we can train AI models to identify this type of content more quickly, more accurately, and with wildly less amount of technological resource to be able to do it. So we're able to report these types of issues very quickly to NCMEC or to local law enforcement, when previously it would take us more time to be able to find that content and report it out.

[00:22:02.50] So that's on the winning side. And I can talk at some point on the challenges that it still presents, if that makes sense.

[00:22:09.00] DAVID SULLIVAN: We will definitely have time to talk about the challenges, but this is a rare panel of guarded optimism in the world of online safety, which is often one of trade offs and sadness, as Dave's wife has put it. So, Dave, turning to you so you can perhaps tell folks a little bit about your background and how you came into this and what the work that you've done over the years, starting at Facebook, Airbnb, OpenAI, and now at Zentropi.

[00:22:44.39] And I think maybe you can help to unpack for this audience, which may be kind of less in the weeds on these issues, what the old sort of model for content policy creation and enforcement looked like, what were the problems with it, and what are the changes that we're seeing that you've been working on and what that could look like concretely.

[00:23:07.95] DAVE WILLNER: Yeah, absolutely. So for context, you did a good job with the panel. We all interlink. So I started my career at

Facebook quite early on as a content moderator and ended up writing the company's initial content policies because those didn't exist and there was no one to do it, and I foolishly volunteered. I was there for six years and worked on both the content policy and the tooling for implementing the policy, because when companies are small, these kinds of things are less differentiated. Then spent six years at Airbnb working on problems very similar to the Tripadvisor set of issues, but with an additional side of Craigslist problems because people are meeting in real life.

[00:23:51.95] And similarly there, thought a lot about your policy and its intersection with tooling and how we make the policies real, because if the rules that you have, no matter what they say, can't be performed by the company, they're not really rules. They're like a cool set of hopes you wrote on your website, which don't help anyone. Ended up, after Airbnb, at OpenAI doing a sort of similar set of things of helping them figure out what the rules of the road should be for the launch of Dall-E, ChatGPT, and GPT-4.

[00:24:20.43] And got fascinated by the subject of this panel, which is the observation, which in retrospect fits with a lot of the rest of what I've done in my career, that we've always, in trust and safety, been trying to push forward the frontier of what we could automate, because the fundamental governing dynamic of online trust and safety is one of being completely overwhelmed by the scale of the problem you're facing compared to the number of people you have to attack the problem. And so in my time at Facebook, we worked on the first implementation of something called PhotoDNA, which is the industry shared hashing database for identifying known CSAM images, which seemed like a really great solution at the time, and then everybody got way better at producing images.

[00:25:03.74] And so the known image cataloging thing, while still helpful, fell behind and we needed new technology. And similarly at Airbnb, we did a lot of work on various kinds of prediction around when reservations might go wrong and lead to violent incidents, but that was limited and difficult to do and inaccurate and messy. And then all across that board, we spent a lot of time on various sorts of historical black box machine learning classifiers. Classifiers, more primitive versions of AI than what we're talking about here today, have been used in the field for a very long time to try to identify content, but they were cumbersome to train, very inaccurate, had all kinds of problems, still often better than nothing as a pre-filter, but not great.

[00:25:48.64] And in my time at OpenAI, I had this scales from my eyes moment of like, oh, this machinery that we're working on is going to cause an enormous number of problems because it can do all of these very powerful things in terms of content generation. But also, it can do something functionally closer to reading and giving a verdict based on that reading. It's closer to what we've previously only been able to have humans help us do.

[00:26:15.44] And if we can take seriously the possibility there of, hey, can we train an AI model using generative AI, using language models, to not just predict the outcome of a given piece of content based on a bunch of statistical patterns, but actually read a content policy, a set of criteria, no matter how idiosyncratic, and apply that specific set of criteria in that moment to a piece of content to identify it, we then have a system where we could change the criteria and immediately change our entire scale classification system. And so I ended up leaving OpenAI, going to Stanford for a year, where I met my co-founder who had a similar like, oh my God realization. And the two of us liked working together so well and made so much progress that we were able to fine tune a very, very, very small language model, think something like 1% the size of GPT-4 or 5.

[00:27:13.53] So it's fast. It's cheap. It was something we could open source that is tuned specifically to follow content policy instructions and apply them. And that small scale means that at the scale the trust and safety operates at, you can actually afford, as both a financial matter and a latency matter from a user interface point of view, to deploy this thing and use it to go find stuff. OK, cool. Now, getting to David's actual question.

[00:27:38.79] [LAUGHTER]

[00:27:40.29] Solving that bottleneck of applying policies is one thing, but all systems have bottlenecks. Bottlenecks can never not exist. They just move. And in breaking the bottleneck of policy application, it very rapidly became obvious in working with customers and even our own work that we were also bad at writing policy well. In addition to being bad at applying it, we were also bad at producing it. It's just that hadn't been a problem, because we were so bad at using it that it didn't matter we were bad at writing it.

[00:28:07.77] And so we then turned our focus towards trying to develop agentic systems that could take a policy text, take a set of examples that you had graded, you believed accurately according to that policy text, look at where those lined up and where they did not line up, and use even bigger language models, the $5 term would be agents, so like specially configured AI with particular perspectives, to try to rewrite the policy text to more clearly capture what it is you seemed to want to classify. And we could check whether the rewrite worked, because we could ask our very small, fast grading machine whether it got closer to the labels you said were correct.

[00:28:52.86] And I can get even more into the weeds about how all of this works. But at a high level, it's not just the case that AI, as a practical matter, is something we can use to do better detection, although that is very much true. Being able to do better and more flexible detection changes the design constraints of all of the systems that depend on that detection, and changes the demands of all of the practices we have to support that detection. So it has to change what we need in

terms of having to move towards automating clarifying and refining policy, but also being able to move towards clarifying and refining policy.

[00:29:27.04] And we're not done right. In attacking that bottleneck, there then become other bottlenecks around finding example edge cases because some of these things are very rare. And so you might not even have the examples you need to dial in the policy. So can we go back and help you figure those things out? There's all of these very practical, tactical applications of this stuff that are not theoretical, not long-term forecasts, but are happening now. It's mostly a matter of figuring out how to build a train around the steam engine. The steam engine already exists.

[00:29:56.38] DAVID SULLIVAN: So I want to just check and see whether, Melissa or Becky, you have anything you'd want to weigh in with in response to Dave or to one another before I have some questions as well, but just--

[00:30:07.50] MELISSA STROEBEL: Mm-hmm. Good.

[00:30:09.40] DAVID SULLIVAN: No? OK. So I think maybe to go back to some of the issues that Harry raised in his keynote and questions about what's the impact of AI on employment and labor. When we think about this world, you all have, in different respects, experiences of having done frontline, either content moderation or receiving and analyzing those reports at NCMEC, Melissa. We know that automation is going to and the move to AI is transforming the way that humans work with in these jobs, some of which has been widely reported as not being great.

[00:31:02.39] But at the same time, there's, I think, potential for a fair amount of dislocation. And just would be curious to hear from each of you about how you feel, where you see, without making overambitious predictions, but let's talk sort of trends in terms of the role of humans and the role of technology when it comes to dealing with the kind of content and behavior we're trying to do something about in your jobs.

[00:31:33.03] BECKY FOLEY: I'm happy to kick it off. So I don't think that it is possible to ignore the fact that, especially when you just heard me talking about 99.7% of text moderation is now automated and in a more accurate way than the humans that were previously doing it. The thing that is changing is the type of work that those humans are doing. So in trust and safety, and in most customer service or support functions, there's a race. How many can you do in an hour? How many can you do it correctly in an hour? A constant push to be able to do it faster.

[00:32:12.93] And a lot of times the humans that are doing this review don't have the time or the autonomy to necessarily sit back and figure out how to do it 100% correct. So what we've seen actually is just that there is a shift in the speed required to do the work, because what's

being done right now is the most complex work from those that are doing content moderation or trust and safety or off-platform safety work with Tripadvisor. And so they have more flexibility, more time to be able to do those more complex cases, support cases, et cetera, correctly.

[00:32:54.75] So, yes, the role has changed. It's shifted. And it's actually shifted for the better at Tripadvisor in better pursuit of serving our customers and our travelers in the best way.

[00:33:13.68] MELISSA STROEBEL: For us, one of the biggest things is we always need a human in the exchange for the issue that we look at, and I think for some of the others. And that's not to say all of it. And that has been slow progress. When PhotoDNA came along, I still remember there was so much resistance among those of us even that were reviewing the content to trust the PDNA signatures even. And we're not even getting into classifiers at that point because of the concern that you might miss one, just one. And that weighs with CSAM or any other crime type.

[00:33:57.22] The thing that could slip through is scary to the people who raise their hand to do this every single day. And at the same time, there's so much need. We are so under-resourced in this area. We are just starting to get a little bit more current in terms of instead of reviewing the image that we have already looked at that exact same image 1,000 times this week alone, well, now instead we're seeing new content and we're seeing predictions of this is a text exchange which is showing all the signs of sadistic extortion and a group, a network, around that.

[00:34:43.18] And so what it ultimately is enabling us to do is to get better in building a safer community in general and focus our efforts there, responding ahead of when the actual abuse has happened in the sense of we were always hanging on CSAM had to have been created. And anything before that, there was no world where you were getting to anything before CSAM was being produced, being shared, really importantly, because oftentimes that's what, and that it would have to be recognized. If you're on a platform that has over a billion files being shared every single day to find that needle in the haystack, we've got a really long road to walk before some of that really starts too, that the teams we work with generally still don't have a queue that's insanely long for them to be getting to.

[00:35:42.25] So that's kind of a non-answer for you, but I'm just excited to spend more of our time looking for the kids who are still in active abuse, instead of trying to find the pictures of that abuse happening.

[00:35:56.89] DAVE WILLNER: Yeah, I will cop to being a naked and perhaps somewhat unpopularly so optimist here, at least in our domain in particular. And I say this having done this job, having done a

bunch of the review, not, I think, as much as you ended up doing, but done a bunch of the review as part of the PhotoDNA work, jobs are not good for people simply because they exist. And we need to differentiate between the broader concern about a good economic transition in what I think is basically an industrial transition moment, which historically, in my understanding, we have not managed super well.

[00:36:38.29] And from feeling sad about certain kinds of job roles going away simply because they exist as job roles that you can be employed for today, because some things you can get paid money for are horrifying. And it is actively good if we can find a way to substitute for needing humans to do those things. And to me, the front line, all I do all day is sit in a queue and grind away looking for these awful things, or even worse, looking through an already filtered queue of awful things to find the most particularly awful ones is not conducive to human thriving. And it's good if we are able to find ways to substitute in for that.

[00:37:19.10] I'd also say, I think particularly in a legal context, there's often a gap I have found between people's understanding of what the scale of the process means, and you both touched on this, and how the judgment making can work. Because when you say things like, oh, well, folks don't have a lot of time, the response you often get is like, give them more time. But you can give them 10 times more time, and that's still only 30 seconds, and 30 seconds is still not enough time to make the judgment any better. But it does make you have to hire 10 times more people, which then means you have to train 10 times more people, which then actually makes things worse.

[00:37:57.26] And so the scale of the problem binds what you can achieve with people in ways that, in my experience, tend to make humans less capable than you might think they are at doing certain kinds of the judgments in practice at the scale that those judgments have to be performed. The PhotoDNA example here was really instructive. We were trying to establish standards to classify those banks, to classify material into, we have to send this to NCMEC versus, legally, we don't have to send this to NCMEC and we don't want to because we don't want to flood their queues, but it's still really gross and we want to delete it, and, hey, actually, we don't care about this, we don't want to review it again.

[00:38:37.34] And the folks that we had been having doing NCMEC reports, who were all employees who went to Stanford and Harvard, other enthusiastic young people, we had them do some grading exercises without talking to each other. And they agreed about 40% of the time about what we should be sending to NCMEC because we had assumed that they had reached consensus, absent guidance, and they hadn't. And the way that we ended up solving that was we in practice built an algorithm, albeit not out of technology. We went and built a

flow chart of a bunch of specific judgments for how to end up in category A and how to end up in category B.

[00:39:14.43] And at that point, you are, in fact, already automating. You're just forcing people to do the automation, which I don't see as better if the results are not somehow clearly better.

[00:39:27.55] MELISSA STROEBEL: Yeah. And another example that I've heard of, and I find the example so illustrative, it's just we don't necessarily think of-- well, that's the place where AI could make such a huge difference. And trust and safety has got similar examples of this with the policies and the algorithms to help align. One of the ones that comes to mind for investigators when they're putting in for a search warrant or for an arrest warrant off of CSAM images, this is literally a crime scene photo of a child's assault, and that investigator has to sit down and write out the description of everything that they see in that image so that can be presented, because oftentimes the image is not what is presented to a court or to a judge or to a sentencing commission.

[00:40:21.73] They have to sit there and write down what they see in that image. AI can do that. There's no reason that that investigator who could be now going on to the next case or that investigator that's already seen that image hundreds of times, as they scrutinize every possible birthmark or tire or license plate to help find that child, there's no reason in the world why that dad, before he gets to go home and have dinner with his kids, has to write that out. That's something AI is doing for us now and is being increasingly trained to do well.

[00:40:59.34] You still need to have somebody review it. It has to be reviewed for accuracy until we get to the place that it is trusted and it is performant or enough. But there will be a point where that investigator doesn't have to do that anymore, and that's a huge win.

[00:41:14.32] DAVE WILLNER: Building on that, actually, another sort of conflation I think we do is assuming that because the automation we've historically encountered in these domains or in domains of language. Everybody calls the pharmacy and then yells at the bot to let them talk to a person because the bot is incompetent.

[00:41:32.86] MELISSA STROEBEL: I don't yell. I say it very calmly.

[00:41:34.82] DAVE WILLNER: I just say I just start saying, human, human, human, until it gives up. But I don't actually think we dislike talking to the pharmacy bot. I think we dislike that the pharmacy bot is bad at its job. And that is important to distinguish in thinking about this. And this moment to me is very exciting as I majored in anthropology. I am not an engineer. I cannot code. My co-founder went to MIT. So our technology is safe to use.

[00:42:01.38] But the amount that you can do as a practitioner and an expert in one of these more humanistic areas now from an automation

point of view is vastly, vastly better than it was two or three years ago. And to me, that is probably the secret to getting to automation that is, in fact, trustworthy. Because instead of the automation coming out of folks who don't have the subject matter expertise, but have the expertise to be able to make automation, it can actually come from the people who have the ground level expertise in doing the thing and who are able to build the trustworthy building blocks as they go along, such that the end system is one that you can actually rely on, but that is itself work.

[00:42:41.70] It's a frankly more interesting, I think, certainly fun kind of work, but it's not going to just happen. You don't just plug it in and it gets solved. You have to do the work of figuring out, how do I get this to be reliable enough that I can actually trust it?

[00:42:56.17] DAVID SULLIVAN: All right. Well, let's not be too optimistic here. So I am curious, just given the, one, amount of news stories recently come with various challenges that are being exacerbated or enabled by AI, whether it comes to, yeah, AI-generated, CSAM, fake reviews, non-consensual intimate imagery, the list goes on and on. So there is a bit of an arms race here in terms of, can our AI deal with the stuff that others are using AI to throw at us? And would just be curious to get here from each of you a little bit of where you see that happening right now and what are maybe some promising developments in terms of trying to deal with some of those kind of AI-generated risks and harms.

[00:43:52.85] BECKY FOLEY: I can start. Well, one of the things that I would say, so one of the risks that you'll hear a lot in my industry is that AI has catapulted fake reviews into an undetectable percent of content. And in reality, that is not actually true in that AI-generated text in reviews is only present in less than 5% of fake content that we've detected at Tripadvisor. And we have very accurate detection methods for AI-generated texts that we've tested across multiple different platforms and use cases. And what it is is that we're using that signal. We call it a signal.

[00:44:42.95] Every single piece of content submitted to Tripadvisor is associated with hundreds of pieces of metadata that we use to collect patterns of abnormality for fake content. And we use AI-generated text as a signal, but it's definitely not the piece that's the silver bullet that says, yes, this is definitely a fake piece of content. There's a ton of people using AI to generate content in really good ways, people that find it much easier to use AI to write about their experiences, but they had a genuine experience. So I think that, yes, AI for user-generated content is definitely a challenge. Authentic user-generated content has never been more desired than it is right now and today.

[00:45:35.58] And particularly when you're looking for advice on something on where to go or how to spend your hard-earned money on a trip, you're looking for authentic experiences. And that's definitely

something that as AI becomes more prolific in search results and in helping you make those decisions, purchasing decisions, it still needs to be rooted in authentic advice or guidance from others who have been there before you or bought that product before you. So that won't change. And the use of AI won't change necessarily the ability for us to get that authentic content.

[00:46:19.36] So it definitely has been another tool that bad actors are using to try and circumvent our systems, but it's just this isn't the first new tool or new technology that's come that has helped bad actors be more prolific.

[00:46:40.62] MELISSA STROEBEL: I don't want to be predictable on being doom and gloom, so I'm going to take a different approach. I think everybody in the room has heard about the scary nature and scale of deepfakes. For me, if I can find a silver lining in everything that AI is bringing in terms of risks for young people as it relates to sexual exploitation is it is really challenging us to fall back on more durable protective factors like open conversations with their families, with their communities, learning about the impacts. We've done surveys with young people about deep fakes as an example.

[00:47:24.69] And this was data collected two or three years ago now. So it was really before it was even gaining the momentum. And at that point, of the teens that we surveyed, 1 in 17 had already experienced somebody creating a deepfake of them. So now that can maybe feel like a small number, but think about how many kids are in the average high school classroom. Think about how many kids are on the soccer team. It is impacting kids. It's impacting their communities. They're coming up against it. And oftentimes, it is other kids who are creating the deepfakes of them.

[00:48:02.55] And we have seen the response from this. We have seen it swaying everywhere from, well, we need to lock up that 14-year-old and throw away the key, they're a sex offender because they created a deepfake, to the other end of the spectrum of, well, boys will be boys. And the reality is when we talk to those kids, more kids than the adults that we've spoken to are very clear that creating a deep fake of somebody is wrong. It doesn't matter that it is fake, it is synthetic. It does not matter. More kids than adults see clearly that it is not acceptable to create a nonconsensual nude of someone else.

[00:48:45.23] That's something to give us hope. They have greater clarity than some of the adults out there do. And it's also putting the response to adults that we cannot default to the conversation of, well, just don't talk to strangers, just don't share nudes. If you just don't share nudes, you're never going to be sextorted. The reality is, in the kids that we've spoken with who have experienced sextortion, 1 on 8 of them were threatened with a deepfake. So not taking an image is not enough anymore.

[00:49:20.71] And as parents, we need to realize that if a child comes to us and says, this is happening to me, I swear I didn't take that picture, and with our own eyes we can't tell the difference, we have to trust our kids as much as we're asking them to trust us that we will be a safe space for them if something goes wrong online. And so I'm seeing a lot more conversation around that right now than the default, well, just don't share nudes, just don't talk to strangers, because there's a need for a much more durable relationship there to help our young people navigate online experiences, not just as teenagers, because that world doesn't change when they turn 18, and we need to make sure that they're prepared for that as well.

[00:50:08.88] DAVE WILLNER: I get to be the maybe somewhat less optimistic-- it's complicated this time. I think that we are in an arms race, because the production of all of this stuff is dramatically easier. On the optimistic note, before getting to the pessimism, defense is always disproportionately more expensive than offense and requires more labor. And so all else equal, it does seem to me that labor saving devices are probably more helpful to us. However, figuring out how to defend well is more complicated to do than figuring out how to wreck things.

[00:50:48.04] And so part of the reason we ended up starting this company is we think it's actually deeply urgent that given that this technology just does exist and is not going to stop existing, we figure out how to use it as soon as possible, because it's going to take us longer to figure out how to use it well. That said, there are certain things where it's very hard for me to see how you use the technology in a helpful way defensively or it's much more difficult. And here I want to differentiate between content that is fake and content that is bad, to be reductionist.

[00:51:24.22] Insofar as content contains a thing that you can recognize by looking at the image or reading the text, we are going to be able to tackle that from an automation point of view, because it doesn't really matter whether you had an AI write the racist threat, it's a racist threat. And so you can just recognize that it is that thing which is, per se, something you don't want and act on it. That gets really complicated in places where the content is not necessarily bad. And this is where NCII gets really complicated, because surface level, the consent is not in the image. It is simply a nude image.

[00:52:05.89] And so we've always, I think, struggled with dealing with that even in a pre-AI world. And it feels more difficult to tackle those kinds of problems from a sort of defensive automation point of view, because the thing that you want to hinge the judgment on isn't knowable to any AI in looking at the image. And that feels like it's going to be a really difficult road for us. Other places like this are misinformation, disinformation, anything where truth or accuracy is the background question. Not saying you can't do it, but it's a lot more complicated.

[00:52:44.87] You start to have to think about database sources to try to feed into the AI to cross verify, and that is going to be tough and we're going to struggle to figure that out.

[00:52:55.37] DAVID SULLIVAN: So maybe we're going to go to questions momentarily. But just to tie those three observations together, it's that whether it's the people who are using your service, the people out there in the world who could potentially fall victim to some of these tools and tactics, or if you're a person trying to figure out how to play defense against this, there is a essential human element that will never go away, no matter how challenging or how good the technological opportunities to work there is. And so I think with that, we can probably open it up to questions from the audience.

[00:53:33.57] As many folks here know, at the Silicon Flatirons, we have the Phil Weiser rule that a student should ask the first question. I hope that some students have some questions prepared, and we'll take as guidance from faculty to identify students if we don't have one. But I see one right here in the front. Do we have a microphone? Yeah, here we go.

[00:54:03.70] AUDIENCE: OK. Real quick, I'm not a CF student, but I'm a college student. Is that still fine?

[00:54:08.32] DAVID SULLIVAN: Yes, yes.

[00:54:09.32] [LAUGHTER]

[00:54:11.10] AUDIENCE: So we're in a law firm, right now our law school, and so my question is going to be more focused about law. Our legal system evolved around the assumption that decision makers have moral agency and responsibility. But as algorithmic systems increasingly influence our decisions in finance, law, hiring and governance, we effectively delegate authority to those systems without any moral understanding, only statistical optimization. Do you think our legal framework is fundamentally unprepared for this shift? And how should we think about accountability when the decision-maker is an algorithm?

[00:54:43.22] DAVID SULLIVAN: It's a great question. I will open it up to our panel with, I think, the caveat that I think this is not unheard of but relatively uncommon Silicon Flatirons panel, where I don't think we have any lawyers up here. So no legal advice to be offered. But if anybody wants to jump in on that one.

[00:55:01.20] BECKY FOLEY: I do think it's important to sit behind the fact that at this point, for the most part, most of the algorithms that platforms are implementing are built by humans, and there are a lot of checks and balances in place, especially for publicly leveraged algorithms. And so that level of there's a few different things is making sure that there's the transparency in place. And actually, by law, specifically in the EU and in the UK, transparency is required. So when

you have those algorithms, you have to actually explain what went into them, how they were built, how you're testing them, how people are allowed to appeal the algorithmic decisions.

[00:55:47.27] And I know Tripadvisor Group actually applies those laws globally. So there's transparency here in the US that is above and beyond the US required transparency. And so that's really how we're thinking about it. Yes, everything is built algorithmically and by humans with human checks and with user accountability in place.

[00:56:14.35] DAVID SULLIVAN: Anybody else want to jump in on that or?

[00:56:17.11] MELISSA STROEBEL: I think that caps it off.

[00:56:18.51] DAVE WILLNER: Yeah, I'm not as worried about it in the specific domain we work in because a lot of the work in the domain we work in has been automated for a very long time. And so it's a field with a lot of muscles and instincts around how to think about responsibility for your automated systems. I am actually pretty worried about it in the context of things like people's personal assistant agents. I am not a lawyer, but I don't understand how your open claw went out and signed a contract is supposed to work or make any sense.

[00:56:49.79] So yeah, I think your anxiety about the systems themselves not being set up for a world in which things that are not people can do something that seems like agency is valid, but what we do about that I have no idea.

[00:57:06.39] DAVID SULLIVAN: So maybe we can take a couple of questions. I see two in the back there. And we'll take those two and then see if we can work in a couple more.

[00:57:17.55] AUDIENCE: Hello, my name is Vicky Mandell. I'm an attorney that does a lot of regulatory work in different areas, including data privacy. So going to the question of offense defense, is it possible to train AI to make decisions based on kindness and compassion?

[00:57:43.32] DAVID SULLIVAN: And let's take the gentleman who was standing in the rear as well and then we can divvy those up.

[00:57:50.68] AUDIENCE: OK. Hey, my name is Ken Fricklas. I'm here in the context of I'm the Head of Multimodal Safety for ML Commons. I've actually worked a little bit with Melissa in the past. And basically, my question is more about who has responsibility. So on an ethical basis, you've got tool vendors who are creating the generative tools which allow you to create deepfakes, for example. There's also the users. And so there is a trade off between these three parties who are part of this system, one of which is the guys who are actually letting you build the deepfake, one of which is the one platform on which you're posting it, and the third one is the end user who's actually doing the thing that might be illegal.

[00:58:34.28] Gets fairly complex. So I just was wondering if some of you folks can address that. Seems all three of you probably have an opinion on that.

[00:58:44.64] DAVID SULLIVAN: Great. All right.

[00:58:46.60] MELISSA STROEBEL: So just take any of them?

[00:58:48.38] DAVID SULLIVAN: Yeah, take--

[00:58:49.96] MELISSA STROEBEL: Well, so one of the things I would say on that last question is if a model is being created explicitly for the purpose of creating CSAM, to the earlier point of, is this illegal, yes, no, at that point, there's clear intent behind the model production. Now, if you've similarly got, say, a nudifying app that is advertising being able to nudify or to support images, if their gallery is clearly posting CSAM of what users have been able to produce using that service.

[00:59:27.98] And similarly, if you have a user who, number one, say, the output is very clearly CSAM, you don't have much debate over it, if you've got a prepubescent image there as opposed to maybe pubescent, but you also have the prompts involved, and if there are clear directions guiding the model to produce, because we know that there's a lot of opportunity within safety by design to reduce the likelihood of a model being able to output CSAM. But there's also a lot of creativity by users out there who are really working hard to get around some of those. And when there are very clear breadcrumbs about the intent of that, I think that becomes a little bit more black and white with my very narrow scope.

[01:00:18.39] I think maybe that becomes a little more challenging for other media types.

[01:00:27.09] DAVE WILLNER: Yeah, so on your question, I'm on some level less interested in the ethical question than I am in the question of what the useful intervention points are. So I agree with all of that. To me, that points us towards a sort of due diligence kind of idea for both the model makers and the platform distributors. It doesn't strike me as a totally new thing to think about products that have certain kinds of risks and that cannot be reduced to zero, but we have expectations for manufacturers to get it to some acceptable level we've all agreed on. That feels approximately right.

[01:01:03.77] And also, I think we need to think carefully about where we put responsibility from a sort of realistic reduction in the volume of harm point of view. And to me, that's maybe more important than the who is morally responsible question, because I am pretty pessimistic given the difficulties that systems like NCMEC already have with keeping up with the volumes of reports we have that we can individual responsibility our way out of this just as a purely practical matter, no matter where you net out on the ethical question.

[01:01:38.70] So agree, but also tend to think we need to push more upstream simply pragmatically since we all agree this is bad and shouldn't happen. On the kindness question, you have to define for me what that means, because it's a pattern repeating machine. And so, yes, you can train AI for some understanding of what kindness and compassion is, but you do that by building a big pile of things you think are kind and compassionate, that are like reasonably, internally consistent, and then it learns to ape the vibe of the pile of kind things you built.

[01:02:19.46] So the question is actually, what is kind and compassionate and how do you know that, and how do we agree that your knowing is right, and how do we then build a big pile of data that is that?

[01:02:30.29] MELISSA STROEBEL: Yeah, and I just want to build on that one there is from, again, from my use case. A big question right now is, what are the risk considerations with a model that is built to behave in a way that is overly human, in terms of behaving in a kind way or behaving in any of those ways? And the impact that could have on the users and kids in particular asking the question of, should models behave in a way that is very clearly reiterating, I am a machine, not a human, I am here to answer questions, I can't be your friend, I can guide you to a support system, I can't be your support system?

[01:03:20.38] And so I think that through my lens that I agree with all of that. Do we have a shared definition of what kind looks like? And from a kid's use case, should a model be trained to behave as a human would at that point?

[01:03:37.63] DAVE WILLNER: I would offer that we have clear evidence that it should not.

[01:03:40.97] [LAUGHTER]

[01:03:42.23] DAVID SULLIVAN: So we're just about at time. I want to give Becky a chance to answer any of that if she wants to.

[01:03:46.91] BECKY FOLEY: The only thing I would add is that, who's responsible? At this point, everything is moving so quickly that every single one of those points is responsible. The app that was used to create the image, text, the platform that is posting it, and the individual user themselves, all three should be culpable for figuring out a solution to make sure that the bad content is not impacting others.

[01:04:14.31] DAVID SULLIVAN: OK, with that, I think we're-- please. Yeah.

[01:04:17.53] [APPLAUSE]

[01:04:18.37] Thank you, Panel.

Panel 2: Emerging Best Practices in Using AI Well

https://youtu.be/lv-XiJ3fYSI

[00:00:00.50] SARAH HANSON: Good morning, everyone. My name is Sarah Hanson. I'm a 2L here at Colorado Law and secretary of the Silicon Flatirons Student Group. I'm delighted to be introducing our next panel, emerging best practices in using AI well. This panel will explore new beneficial AI governance approaches that are often overlooked in media and academic spaces.

[00:00:24.20] We're fortunate to have with us an extraordinary group of experts guiding this discussion. Susan Adams is the founder of Women in AI, Colorado's flagship program, Women in AI labs, which has brought cohort based AI experimentation to over 1,000 women across the country. Dan Linna Jr. is a professor of law at Northwestern's Pritzker School of Law & McCormick school of engineering. His work focuses on applications of AI and data analytics for legal services delivery.

[00:00:56.52] Alexandra Robinson is the director of AI governance at Slalom. She is an internationally recognized leader in AI governance, AI cybersecurity, and technology risk management. Nathan Schneider is an author and associate professor of media studies here at CU. His work focuses on platform cooperativism, democracy, and digital governance. Moderating this panel is Harry Surden, Professor of law at CU in the AI initiative Director at Silicon Flatirons. Please join me in welcoming our fabulous panelists.

[00:01:29.72] [APPLAUSE]

[00:01:33.34] HARRY SURDEN: Well, thank you so much for joining us. I'm the guy from before. So our panel today is entitled nudging artificial intelligence towards a positive future. So what we're here to talk about are the practical tools in our tool set. The norm, the institutional design, the grassroots movement, that can incrementally make AI emerge in a pro-social way. What does it look like when AI goes right and how do we get it there?

[00:02:03.51] So the premise of this discussion is that beneficial technological impact is something that can be actively constructed, and it may not happen by default if left to itself. And there are well studied specific approaches that can make pro-social positive futures more likely, organizational, technical, legal, social, human, flourishing checks and balances, safety nets, benefits and risk management.

[00:02:29.85] There's a whole well-studied toolset that can be actively deployed and should be actively deployed. And understanding these conditions for success is as important as understanding benefits and

risks. So we're in a phase where the choices that we as a society make today, in the next few years, may shape the way AI emerges in the upcoming future. And this is actually empowering.

[00:02:56.11] It means we are-- future is not being passively delivered to us from outside. It's that we as a society and as institutions can shape our own future actively. So just to give you an example, we're seeing this a lot here in the education setting. We, as educators have both the opportunity and the responsibility to help our students thrive in the era of artificial intelligence and other technologies.

[00:03:26.61] So AI has both the opportunity to help learning, but also hurt learning. And we need to be careful for how we use it and how it does. So just for example, we are and should be teaching our students how to use AI well and responsibly through active interaction and reflection.

[00:03:50.73] So as an example, we will have our students use AI in various activities and then step back and critically reflect on how is their AI use affecting their learning. Is AI substituting, or you're replacing your learning, or is it augmenting your learning? We've seen this before. So of course, one of the primary reasons students come to law school is to train their thinking and to learn skills, and we want to encourage them to use AI and other technologies in ways that are enhancing that mission.

[00:04:26.81] So let me give you an example of substituting that we would say, it's not really a good use of AI. So in law school, we read cases-- law cases, and part of the practice is understanding the patterns and the principles and learning to reason. So using AI to read a case for you and summarize it is not good.

[00:04:47.41] And we need to explain that to students, why? Because learning happens through practice, and insight, and active learning. And in that case, the AI is doing the learning for you. By contrast-- this is a very common thing among first year law students-- you read a case and you have no idea what's going on, and you're confused.

[00:05:08.28] At that point, maybe AI can complement and augment learning. It might be able to provide new context, connect dots that might only be connectable by talking to a professor who might not be there at the moment, it can provide you with understanding to help increase your learning. So these are not obvious to students. Unless they step back and think and do an analysis of how their learning is either being helped or hurt by AI, they're not going to learn the tools.

[00:05:40.52] So it's up to institutions like ours to actively articulate those differences to students, but more broadly, to be thinking about pro-social ways to nudge this technology in ways that benefit society. So with that in mind, we have a terrific panel-- and thank you, Sarah for that wonderful introduction-- who are going to be exploring what are

the active processes we, as a society and as institutions can to make it more likely that AI shares benefits widely for all.

[00:06:15.78] So I'm going to throw the first question out to Alexandra. So what-- it's kind of an abstract idea-- what does using AI well mean in practice? So what is a concrete example-- and we saw some on the last panel-- of AI being used well today that deserves more attention? And what made it work, what conditions, organizational, technical, social or governance related, were necessary for that success?

[00:06:45.02] ALEXANDRA ROBINSON: OK, great. So I'm going to examine this question from an institutional and organizational perspective, because enabling the development of AI that works well, really starts with your organizational strategy and a vision of leadership. At this moment in AI adoption, I see so many institutions feeling pressure to just adopt AI for AI sake.

[00:07:12.28] Good AI development is rooted in your organizational and your IT strategy. We can't just invest in AI for AI sake. If you don't know what organizational problems you're solving, if you don't know what kind of return on investment you're expecting, using tokenization or active use of AI as your metric could just be measuring organizational waste, and I see that day after day.

[00:07:41.04] When it comes to good leadership in deciding what AI gets developed, you need your clear yeses and your clear no's. And we're seeing organizations like OpenAI and Anthropic, and really in the heat of that at an organizational level, saying, how is this technology allowed to be used?

[00:08:01.91] But even in small organizations, you need to have your clear yeses and your clear nos for how are we going to develop AI? How are we going to use AI? And that makes decision making easier, versus allowing teams and individuals to get stuck in cycles of ambiguity. So again, coming back to that leadership, any AI use case should be grounded in what are the problems we're trying to solve? How do we know that this works? And designing with users.

[00:08:29.09] I cannot tell you-- time after time I'm seeing development teams just forego the basics of good technology design out of the rush to develop AI and say, we did this. The other part is having the hard conversations. So organizations are starting to enact governance more at the big G governance lingo and having the hard conversations. This is a great way that I see legal teams and compliance and privacy officers actually getting the seat at the table at technology.

[00:09:08.87] These conversations need to happen. They're hard. They're messy. And at the same time organizations to actually develop good AI, need to make doing the right thing easy. So ensuring that people at the table in these conversations have the education about AI to apply their knowledge and understand how systems work to ensure these conversations don't get stuck in ambiguity and don't actually

impact a good design, that's on the organization to figure out those right mechanisms, upskilling tools to enable those conversations.

[00:09:44.11] And then finally, really making doing the right thing easy by embedding good design and governance into your tech stack. So the organizations that I see that are reducing their risk and developing good AI more seamlessly have embedded guardrails into their tech stack. They have embedded efficient testing and evaluation into their pipelines.

[00:10:10.43] They are upskilling their data scientists to be able to test for the social, technical and cyber risks of AI. And they're making that investment so that it's not on the individual user or the system team to reinvent the wheel every time they need to manage the risk of a new product.

[00:10:30.73] HARRY SURDEN: That's great. So just to reflect back on some themes I heard in there. So you want the decision to be thoughtful and deliberate, rather than ad hoc. Done at the organizational level, rather than pushing down on the individual users. We want the decisions to be evaluable in ways it is the AI solving a specific problem and actually doing what we think it's doing. So these are some of the-- great. Anyone else on the panel want to weigh in the same? Yeah.

[00:11:04.30] DANIEL W. LINNA JR: Well, so I'd like to focus on applications of AI and law for my comments today, looking at how AI is being used in law practice, how AI is being used in courts, how AI is being used by individuals to try to close the justice gap. And one of the observations as far as some of the things that are missing, is that we don't really have good understandings of how to measure quality in law, like understanding what good outcomes looks like, what good high quality work product looks like.

[00:11:35.54] And I think an early lesson we can learn is when technology assisted review and e-discovery came along. And so this is about 20 years ago. I was practicing law then, and I was very excited about this technology. But a lot of lawyers I knew and even judges said, well, but it makes mistakes. It's not perfect. How can we use this technology? It's not good enough. And I hear a lot of the same kind of stuff today about, well, AI can't do what I do, and it makes mistakes. We can't possibly use it.

[00:12:05.02] Well, then there was research done. And one of the things that's really missing is research in this space to understand how law is practiced and more at Grossman and Gordon Cormack did a really important research study, where they looked at the human way we reviewed documents. By the way, how many people are law students in the room? OK, a few. How many lawyers do we have in the room? All right, more. And in law faculty, and if you didn't raise your hand, mostly lawyers, probably law faculty. Not all.

[00:12:34.04] But they did this research to compare how well technology assisted review did compared to humans. And if you're not a lawyer, imagine a lawsuit. I did a lot of work representing General Motors. There's something about a dispute in 1995, and you end up with 500 bankers boxes of paper documents, and the dispute is about the specifications for the steel and the wheels. And so you've got to comb through these documents well. Is this related to that or not?

[00:13:02.49] Well, it turns out you can train machines to make those decisions and do pretty well at determining if a document is relevant or not. And it turns out that when humans make those same decisions, inter-rater agreement is about 70% for the gold standard. And so it turns out it's not nearly perfect.

[00:13:18.61] And this kind of underlines the problem where again, we're not evidence based in what we do in law. You think 100 years ago in law and medicine, we're kind of in the same place. Communities of practice that really drove the way people did things.

[00:13:32.03] Medicine took an empirical turn. It's not perfect, but it's much more data driven. They ask, well, hey, results. What results in patients not dying? Let's do more of those things and less of the things that produce bad outcomes. And when I see this surfacing right now, is it's tough to come up with evaluations to ask like, well, what is good? I mean, people are worried about-- we don't want ChatGPT to give bad information to someone who's trying to get back a security deposit or try to avoid eviction.

[00:13:59.97] Well, what is good advice look like? What does a good contract look like? There's more and more of a movement here to gather data around that to understand, how would we evaluate that? What are the kind of things that we would measure? So it makes it difficult to do the evaluations to understand the validity of the tools we're using right now, the reliability of the tools that we're using right now.

[00:14:22.45] But then it also shows up in another place, which is the data to train these systems. And so a lot of times, the idea has been, oh, well, we can use machine learning, fine tuning for generative AI systems. We'll just take-- we've got 5,000 contracts here. And the system-- the machine's going to learn how to write good contracts. Well, are those 5,000 contracts good contracts? How do we know?

[00:14:46.05] And so the field is improving in a lot of these areas, but I think that-- and some of my later comments, what I want to talk about, there's a lot of concern about how these systems can make mistakes when lawyers are using them and when self-represented litigants are using them. But I think we see growing evidence that these tools can be used across this whole space, judges, lawyers, individuals, to help them get higher quality advice, more quickly.

[00:15:11.35] And we can talk about some of-- the main takeaway here though, is that I think we need more research to understand, what do good outcomes look like? What does a good quality contract look like? And we are really lacking in a lot of these areas when it comes to then being able to evaluate artificial intelligence outputs.

[00:15:28.73] HARRY SURDEN: I think that's a terrific point. And there's a lot of stories coming out with lawyers that submit briefs with generated by AI, with mistakes in it. But as somebody who clerked for a judge, I saw a lot of human generated briefs with mistakes. And we didn't really have a metric of the human error rate.

[00:15:49.24] Not to say that AI is necessarily better, but we don't know. It might be better, it might be worse. And certainly, and I want to hear later what you have to say about per se, in people who represent themselves. There's huge amounts of errors there. Anyone want to weigh in on using AI well?

[00:16:07.62] SUSAN ADAMS: I want to double click on Alex's, the need for design governance well. So there's a piece that I've been working on or thinking about is, what it could look like if we had governance that increases people's capacity to be the author of their own minds?

[00:16:25.78] So we keep going into the LLMs. We keep thinking about designing institutions and organizations. I'm coming at this from the human standpoint, and what could it look like to give people access to a reflective practice into their own minds. And there's a new term that's coming up that I'm doing a lot of research on right now called cognitive sovereignty. And it's really about this notion of how do we stay the authors of our own minds in the age of AI.

[00:16:54.92] And I think that's the question that I'd even like to see at these levels of governance. Could that be a societal pro-social movement that we actually start to do that? And I'm experimenting with how we can engage in a metacognitive process of understanding the role that we're giving AI in any given task, which can then uncover whether or not it's right or wrong.

[00:17:22.88] And I have the privilege of being able to do that at the University level, but also starting this women in AI group. And we're calling it women in AI labs because we want to think of it as a laboratory. We want to center the human, center the woman, getting her in a space where she can both feel safe and trusted, but also be in that place where slowing it down enough to say, where is this infiltrating my brain? Cognitive permeability. Where is my identity maybe getting wrapped up in this AI? And where is it not?

[00:17:59.10] Not to slow us down, but to actually make us more and better capable of being a human being, if we're going to engage with and get the benefit of this synthetic intelligence. So that's where I'm thinking about in this panel. Especially when I think about governance,

I want to see more of this, either research given too, or how can we design the governance structures that would then foster that possibility?

[00:18:25.97] HARRY SURDEN: That's great. And I want to hear more about that shortly. That's a terrific point. Did you want to say about using AI well? Do you have any examples?

[00:18:34.81] NATHAN SCHNEIDER: Sure. Maybe I'll just join the head of intial foray. One place that I'm thinking about this very much is our own location at CU Boulder, where we just learned that the system has made a contract with OpenAI for making ChatGPT available to everybody. And one of the rationales used for this was equity. And I think it raises really interesting questions about what equity in this context could mean.

[00:19:07.87] I think it's a reasonable claim in certain respects to say that, OK, this is a state of the art tool that lots of people are using anyway. Let's make sure that everybody has access to it. But there are a lot of respects in which that could be seen as inequitable as for instance, ceding our choices to a company that is making choices for us.

[00:19:37.33] It's making the choices about where to put data centers, about how much land and electricity to consume and water, about what data to gobble up for its training, pre-training, and so forth. And so much more. What biases to instill into the models. Which remote workers to employ to review CSAM material.

[00:20:06.41] There are so many trade offs and decisions that we have ceded in the context of making a contract with a company like this. And I think that when we think about using AI well in the University, we should be asking, what could the University be doing to actually put different options on the table? And I see that as a really important piece of the university's role in society.

[00:20:30.13] And just to give an example, in Switzerland, the Swiss government partnered with a consortium of universities to create a kind of high road LLM called Apertus. Not perfect. It doesn't resolve every trade off. But one thing it does, is it doesn't use stolen data. I'm a beneficiary of the Anthropic lawsuit or settlement around book stealing, but this is something that the designers of this model chose not to engage in, and they were still able to produce a frontier model.

[00:21:02.63] Now, I've been working with some of the engineers who produced it to create an inference cooperative, so that the people who are using the tool are actually co-owning the servers and being able to make their own decisions about, say, energy usage. In my lab, my students are exploring the use of an LLM. And they're really excited about the fact that we're self-hosting it.

[00:21:26.34] So we're figuring out how much of our server resources we want to devote to this. We're embedding it in conversations we're having with Indigenous communities whose data we're stewarding as part of this process. We are owning the trade offs. And this is an opportunity that we only get when we don't see those trade offs to a company whose goal is to lock our students into their products, create profiles of them, and have a group of lifelong paying customers and ad targets.

[00:22:02.00] Finally, I think there's a lot to learn from the lessons of worker control of automation in the past. Often, what we found when we look across different countries, is that where workers have power to guide automation, they're able to do it in a way that is friendly to workers, that automates the work they don't want to do. We saw this a lot in Scandinavian countries and factories in the 70s and so forth, compared to here, where automation becomes a site of conflict because workers know that it's going to be wielded against them.

[00:22:36.34] Even in a company like Microsoft today, in Europe, they have worker councils that have been there just because of European labor law. And those councils of workers are deciding how to implement Microsoft tools within Microsoft offices. How else could we make this a worker, driven process? And just to give an example, for instance, we might think about Hollywood, for instance, and the way in which they used labor power to set the terms-- to try to set some terms for the use of AI.

[00:23:13.82] But also in the context of a law office, I work a lot with a law firm here in town that has employed a worker owned cooperative tech company to develop internal tools, self-hosted AI tools to help facilitate their legal work, and making sure that the worker's voice is at the front, both in terms of their choice of consultants, but also in terms of the development and deployment of their tools in the workplace.

[00:23:46.52] So I think when we cede our choices to a big company that says we will provide AI period, we cede so many interesting conversations and sites of experimentation that we could be doing around this technology. And it's that kind of experimentation that I hope our universities and many other institutions in our lives take up.

[00:24:10.52] HARRY SURDEN: Those are really great comments. And just for the audience to take a step back. In law school, we talk a lot about top down governance. You might imagine a statute or regulation passed by Congress or state government or local. What I'm hearing from you is a different model of grassroots, community governance, community norms, can you say a little bit more about that distinction more abstractly, and some of the benefits of thinking in that mode?

[00:24:37.35] NATHAN SCHNEIDER: Yeah. I think these things are related. But if we've learned one thing about from the history of

regulating the internet, it's that this government doesn't do much of it, and that a lot of it is going to be left to the civil society. And we need to take that up. We need to also recognize that what we're living through right now in the context of the tech industry's relationship to the military, for instance, is the result of a labor struggle.

[00:25:08.99] During the last Trump administration, there were massive walkouts and organizing drives. In the time in between then and now, there were massive layoffs that severely hampered that resistance to engaging in an irresponsible military contracts. Right now, one of the things that is trying to hold the line is Anthropic's corporate structure, which has some values built into it that can create some real pain for the company, akin, in some respects to what we saw with OpenAI a couple of years ago.

[00:25:47.11] But I think right now, if you just look at the scene right now, a lot of the real bulwarks are not coming from policy. They're coming from the kinds of things that people can erect in practice through contracts, through social movements, resistance to data centers. And policy is probably going to come in, maybe in a few decades, pick up the pieces and resolve-- settle things once the dust has settled. But there's a lot that needs to happen between now and then to determine the shape of any outcomes we find.

[00:26:25.23] SUSAN ADAMS: I hope it's not decades. [LAUGHS]

[00:26:27.13] NATHAN SCHNEIDER: If you look at social media, it's like they come around to regulating it. As soon as Mark Zuckerberg is like, we're not a social media company, we're just delivering AI slop all day. [LAUGHS] The moment social media stops actually being the driver of value is the moment where Congress is like, maybe we should pass a law about social media.

[00:26:48.61] HARRY SURDEN: Anyone want to weigh in on bottom up governance, where they're seeing communities or social practices in either-- in the absence of formal regulation or augmenting or substituting for formal regulation?

[00:27:05.07] SUSAN ADAMS: I mean, I'll say here in Boulder, we're experiencing an incredible-- and I'll just put a shout out to Dan Murray, who's in the audience-- we run and support a meetup group that literally went from 50 members to 800 for women in AI in two years, in three years, 3,000. I mean that's grassroots, and all we're doing is a monthly meetup. We're sitting in conversation, and we're solving problems by being in conversation. And we're doing it out of the goodness of our own hearts because we see the need.

[00:27:38.18] But we became this vortex of thank you, thank you, thank you, for allowing us to be in an expression of ourselves, a real concern for what's happening, and then moving forward to say, can we solve this together? And I really do think it requires that community, and I want to see more of those spaces. And we're here today in that same

vein and just appreciating that this is an aggregator in some ways. It's very confrontive for people.

[00:28:11.48] And so, even with faculty, I watched the five stages of grief. And still, faculty cry with me in feeling so confronted that their entire discipline is in their minds destroyed, until they can move forward and see. Actually, there is a way we can empower and be with my discipline, if we roll up our sleeves and think together in a community to solve for this. So that's an example I want to see more of and be watching that progression of our society really, almost the consciousness of our society, as we continue to meet together.

[00:28:48.00] HARRY SURDEN: What I love about that, I hear you and Dan and others taking an active role in trying to shape the society you want, rather than sitting back passively and have it being done to you. And we all have that opportunity.

[00:29:01.72] DANIEL W. LINNA JR: Well, in terms of being active too, I think the courts is another area where we need to be much more active. And I think in all these spaces, we should think about top down and bottom up, both innovation and regulation. And you need people who are closest to the work to understand how these tools can be used to truly innovate and deliver a great result. So you've got to train them. They need to understand the benefits and the risks, and they need to be part of your governance structure.

[00:29:26.76] They play a very important role. So it's both, top down and bottom up. And then just when we think about courts, one of the huge issues here is that, courts are not well funded in the United States. And for the federal government, they can-- they're working on-- I think some of the judges are working on trying to address this at the federal level.

[00:29:47.34] They've got better tools, generally speaking, but many state court jurisdictions, you talk about using Westlaw or Lexis and they don't have a subscription. And you don't say, well, you don't need a policy about these hallucinations. You need to use the technology that can help you identify hallucinations.

[00:30:02.28] Well, we don't have a subscription and I don't want to go and try to beat up our local leaders to get the money to do that. Well, if we want to modernize our courts, we need to figure out how to give them funding, so they have the technology tools, they have the staffing, they have the training, and we're woefully, inadequate in those areas.

[00:30:19.91] ALEXANDRA ROBINSON: I'm going to be a bit of a pessimist here, but not forever. So I think that there's a real power imbalance in terms of shifting big tech and model providers behavior for the next few years, because they are subsidizing the costs of their models and expecting consumers to embed OpenAI and Azure,

whatever it is, into their tech stack, so that you're addicted to it and you're stuck.

[00:30:50.45] And the prices of compute right now are so subsidized and it is not feasible to sustain forever. And when those prices come up, you're going to have very angry customers and companies whose business models and FinOps are out of control. And then you'll have, I think, a backlash.

[00:31:10.45] When you have these data centers being built and enough people are visibly, physically affected by them that they can't sleep, that they can't go outside because of air pollution, that your energy costs are up 500%, you're going to see a backlash. But that's going to happen in two years, and I think civil society needs to think really tactically about how they're going to harness that energy. I think corporations or consumers of enterprise AI technology can start demanding transparency from their model providers and their cloud providers.

[00:31:46.75] So borrowing from the ESG space, when you're having contract negotiations or when you're comparing cloud stacks, ask for transparency about where data centers are hosted? What are the energy resources fueling them? What are their community protections? What are their model policies? Do they allow use of models for autonomous war, whatever? But these are things that companies can start asking now.

[00:32:17.77] And if there's a unified way of asking for that information, we can start benchmarking that more transparently. But model providers are not very transparent or forthcoming about their compute, about their data center use, and that puts a lot of burden on consumers to demand that. And we're not going to get the regulation under this administration that would force it. I think Europe will come out ahead, but we are always going to be behind in terms of using regulation as a lever to combat big tech power dynamics.

[00:32:52.97] HARRY SURDEN: No, I think it's a great point. I think the ESG movement showed that bottom up pressure from customers actually can result in real world change. I think it's a terrific and optimistic point, actually. I thought--

[00:33:05.84] SUSAN ADAMS: --just delayed optimism.

[00:33:07.30] HARRY SURDEN: Delayed optimism. Yeah. So, Susan, I want to return to your earlier point about cognitive sovereignty. Could you say a little bit more about that and how deliberateness in our relationships with technology can promote or at least nudge flourishing and thriving?

[00:33:26.60] SUSAN ADAMS: Yeah. Well, I'm really in the experiment phase of it right now. I'm designing a course down at DU for this, where I'm hoping, or at least I'm looking at, is there going to be a

transformation from even week two to week 10 for a student that begins to take that reflective stance? Even in the midst of building projects and thinking about automation flows, would there be power and benefit to taking that step back? Or is it even a step right beside?

[00:33:59.18] So I'm thinking about words like metacognitive agility. So being able to be agile enough to have that pause point to make a choice about how much is this influencing my thinking. And I'm mostly in a way, concerned about the 15 to 22-year-olds. That's where there's such an important developmental stage for our own identities and our own ability to be in the practice of thinking.

[00:34:27.54] And yet, when I'm also in my women in AI labs, I still see it in adults, too. So I don't think it's necessarily an age piece, if we imagine what does it mean to develop our minds over time. But this technology, this synthetic intelligence is the first time we've actually had a mirror to ourselves. So I think that has the potential for us to actually see our thinking patterns for the first time, to recognize what our biases are.

[00:34:56.96] And there's going to be a lot of research and a lot of even wringing of our hands of the bias of the algorithms. That is going to be true, and I can help with that. But I'm much more interested. And I think we need to be putting just as much research and experimentation into our own minds and our own bodies in terms of raising that capacity. So that's where the cognitive sovereignty frame comes in, and I almost want to encourage every University to have a lab that helps us look at that, and how we raise that capability.

[00:35:28.98] HARRY SURDEN: I really love that because I think we've all experienced a lack of cognitive sovereignty in social media and smartphones, where some of us mindlessly scroll through things, not reflecting on our relationship with our device, and also not reflecting on the view of the world that we're getting.

[00:35:49.38] We think what's coming through our feeds is a reflection of the way the world is, not a skewed and algorithmically presented view of the way the world is being presented to us. Taking metacognition in a relationship with AI, taking a pause and thinking, what is AI giving me? What is my relationship to this information? Developing critical thinking in society is really important.

[00:36:17.91] SUSAN ADAMS: And I think the environmental question, Alex, you bring up. Professor was speaking to me recently and actually, you and I talked about this last night, is this idea of the Faustian bargain. We have to bargain with-- what is it-- eight glasses of water for every interaction with AI. And that's a trade off for the fact that you also watched a Netflix movie last night. Or you took a plane to a conference and you got the exchange of being on that plane to actually be in a conference and learn something and maybe get a new job.

[00:36:51.75] We're bargaining every single day. And I think that's another reason to have this cognitive sovereignty. Our brains are online enough to be in that space, to know what that bargaining is. And in so many ways, that is deeply personal. And yet we are at the helm and the front lines of institutional policy and governance and needs. But to me, that needs to be in service to that individual coming to these themselves, and those decisions themselves.

[00:37:21.43] NATHAN SCHNEIDER: Yeah. I would argue, I think it's got to be both individual and collective. Any sovereignty, I think, is in some respects collective. And these decisions have to be collective. In the same way that the trade off I take by taking a flight to visit my relatives in Ohio could be different if for instance, our government invested in high speed rail across the country, that's a collective choice that we could make.

[00:37:52.62] Or maybe that my organization chooses to use a provider that uses renewable energy for AI or something like that, makes an intentional choice. And also, one thing I've noticed is that my personal choices get affected by the culture around me. I have a lot of colleagues who are really skeptical of live AI use more than me. And it actually has been forcing me to be more intentional.

[00:38:21.10] And I've been appreciating their skepticism because I'm like, did I really understand that thing I just got out of that bot? And that's a really important practice. One thing I'd also add is, the thing I scroll on is not like TikTok. It's like threads of software engineers talking to each other. I don't know why I get so much pleasure out of this.

[00:38:42.52] But it's really interesting to see the kinds of practices developing in the kind of engineering rigs that people are developing to do with what they view as responsible software development with AI. They're building all kinds of agents, dotMD files, and workflows, and specifying what they're doing. The creator of Claude Code recently posted his cloud dotMD file. And it's all about, developing intentional practices through ongoing relationship with these machines.

[00:39:18.72] And I think that's a useful, personal practice to develop, to recognize, again, that the tool as given, might not be a responsible thing to use, but you can cultivate your relationship with the tool. Your organization can-- as you said-- cultivate a responsible Apertus infrastructure that makes, for instance, a cognitive sovereignty. Not a burden that we impose on the individual, but is something that we as a society are cultivating together.

[00:39:54.18] DANIEL W. LINNA JR: I want to pick up one you said early on, Harry, about we have a responsibility to teach law students to use this technology responsibly and well. And I think more and more law faculty are seeing that we need to teach students to use it

responsibly. Maybe not the well part, but I fear, unfortunately, that's still the minority opinion across all of law faculty in the US.

[00:40:18.12] But I also think that we need to change our mental models of how these tools are used and demonstrate how these tools can actually be used to accelerate learning. I think back when I went to law school, I was required to do research in the books before I was allowed to touch a computer. And most of my faculty were convinced that I'd never be a real lawyer or a good lawyer, if I didn't know how to use the books and then find that pocket part in the back.

[00:40:43.55] That didn't last very long before we realized, oh, let's just go use the computers and do research. I think we're going to be there pretty quickly with AI. I think it's pretty much already here. Any sort of policy that AI is "banned" is totally-- you can't administrate it. I think it's coming in many opaque ways into how students use these tools.

[00:41:02.77] So we should be teaching them how to use them, and we should be building tools to help them in a couple-- just a couple quick examples I want to give. I've been creating conversational AI tools in my writing classes, three different ones. Students interact when they choose a paper topic, and it forces them to think about, who's the audience? Why do I want to write about this? What is the scope of this? Should I narrow the scope?

[00:41:22.43] And then they turn in a transcript of that. Same thing when they create an outline. So I broke writing process down into phases. They have to come up with a thesis statement, and then write a full sentence, outline with topic sentences. They iterate with the AI system that I've created, turn in that transcript, and then I give them feedback in the outline. They turn in a final paper, same thing.

[00:41:41.75] In our Innovation Lab, we're creating a moot court simulator. So it's an avatar of a judge. Some of these are already out there. Some law firms are using this. People's law school in Canada created something like this, but the idea is you put the briefs and you have to go to court and argue a motion. Or you're arguing in front of a Court of Appeals, you're loading the briefs, you could even give the system some of the opinions that the judge has written in the past, and it will ask you questions. It will moot you.

[00:42:07.45] And of course, as a practicing lawyer, I did this. And if you're in a law school, you can have a professor do that. But there's not nearly enough time to do as much as you would like. So having these simulations could really accelerate learning.

[00:42:21.13] I think we're just barely scratching the surface in the way that we can use these tools to accelerate learning for students. And we have to stop giving the easy option for faculty of "banning" the tools because it's cheating. We need to be a little more thoughtful about how these tools can be used responsibly and well.

[00:42:37.33] HARRY SURDEN: This is a great point. And this follows up on a point you just made, which is, it's forcing educators to see what aspects of existing education are just artifacts of the way things were, whether it's the five part essay or--

[00:42:55.49] SUSAN ADAMS: --which really was a proxy for critical thinking.

[00:42:58.83] HARRY SURDEN: Exactly. Or the Westlaw keynote paper. And which parts are actually important to learning? And we should be open to understanding what was valuable about the old system, but also not clinging on to it, if there as an artifact, and it's not helping our ultimate goal, which is helping our students learn and thrive.

[00:43:19.25] NATHAN SCHNEIDER: I love Susan's point about the stages of grief. [LAUGHS] Guilty as charged. I mean, my first year, I was just doing lots of honor code reports and feeling very angry with my TAs and about all the slop we were getting. And then I started realizing, oh, this is just actually shining a light on a lot of rote, unthoughtful assignments.

[00:43:45.04] And I've turned a lot more toward orality, which was I think, old fashioned education. Was about memory and speech. And I think this is an opportunity to come back to that and to recognize the way in which we've been leaning on the college essay in a way that has become corrosive. And one thing too, that I found in my classes is that when you actually turn what they're turning in over to each other, they start coming to some interesting conclusions themselves.

[00:44:20.52] Again, this to me, comes back to the question of what would it look like if you had your workers in a workplace talking to each other about what they really want out of these tools? When students start having to see and think through and respond to each other's work, they are just as annoyed by slop as I am, which isn't to say that they think AI is terrible, but they can see the difference between something that's thought through and something that was a one shot prompt.

[00:44:52.28] And that to me, is really exciting. Is that actually this is an invitation to get back to basics, to hold spaces together, to think together. One thing I'll just add too, is we did an event on AI earlier this week and raising questions about the ChatGPT deal, group of faculty from across campus. And it was a bunch of faculty talking at people, unfortunately. But then the students started speaking, and one of them talked about a petition that he had created to get his professors to stop doing bad AI stuff on their work.

[00:45:35.30] And it was because they'd had professors who wasted their time with bad AI tests that actually were unsolvable. And so the professors were being lazy. And that was a reminder to me of just how important power balances are throughout this, is that one definition of

AI is an attempt to centralize power that was previously distributed. It's an attempt to automate and centralize.

[00:46:03.86] And we need to be really, really attentive to the temptations of using this technology as a way to assert power over others. And what I've found is that when you realize that you're doing that and you break it down, and you shift gears and you open up a conversation, really, really interesting stuff emerges. Just like the students in that classroom actually realizing that there was a problem and encouraging each other to do better.

[00:46:32.13] DANIEL W. LINNA JR: I'm glad you mentioned oral exams because that's something I should have mentioned. That's something else I'm incorporating with using these AI tools. And also things like peer reviews. And I think especially in professional schools, we too often design education so that students learn from the professor only.

[00:46:46.93] And it's like we have amazing students in law schools all across the country. How do we create more opportunities for the students to learn from each other as well? So just some changes in the design of the course to accelerate learning, faster learning.

[00:46:59.29] HARRY SURDEN: I love that. And another example of bottom up governance. Alexandra?

[00:47:03.07] ALEXANDRA ROBINSON: One thing I would caution here is universal standards or expectations of what using AI well means. What I'm seeing in corporate America is a CEO or someone in power equating using AI equals using AI well. If you had a CEO that was like, our big initiative this year is teaching people how to parent, and their outcome was everyone has kids, you'd think that was insane.

[00:47:38.69] Because your workforce is not homogeneous and people's relationships with technology is not homogeneous. Their backgrounds, their barriers, their experiences in society with technology is not homogeneous. So we're seeing that women are 25% less likely to use commercial genAI tools than men. And from the CEO corporate perspective, where they're saying, if you don't want to use AI, then you're not a good worker and get out, you're obsolete. That is coming from the assumption that suspicion around a technology is bad.

[00:48:17.53] Whereas I think, this panel would say that being critical of a technology, being critical of its outputs, actually makes you a good user and that you're a better equipped user of its outputs. So where are those biases coming from? How do we switch that? And how do we actually look at our student population or our workforce not as homogeneous, but take that human centered perspective, take a social technical perspective and meet people where they are, and also give them tools and training that actually meets their needs and their jobs?

[00:48:57.87] If I just roll out Copilot to my entire workforce, of course, some people are going to be excited and trusting and using it, and some people are just not going to know how. And if I give them a one day training where everyone is in the same room, there are a lot of people that aren't going to feel safe asking questions or sharing their concerns around, is this being used for worker surveillance? Is this training me out of a job? So you have to create those spaces for your entire workforce, meaning all of your subsets of your workforce to adopt a tool that meets their needs.

[00:49:33.94] HARRY SURDEN: I love that. And it reflects an earlier theme about AI adoption not being reflexive, but being deliberate, thoughtful, and nuanced at the organizational level.

[00:49:44.20] NATHAN SCHNEIDER: I also just really want to lift up that surveillance point. I think it's a really important issue. And it's real for a lot of workers. In the same way that social media was about capturing a previously non commodified thing, relationships, and turning it into a commodity, these tools have the potential to turn thought into a commodity.

[00:50:11.60] The more that we lean on these things for our thought processes and we cede the power and control over them to companies outside of-- much more powerful than us or even our employer. It's a real move, and in addition to the domestic surveillance issues that come up. And I think it's absolutely essential to draw really, really hard lines around the way in which data flows and what is protected about our interactions with these machines.

[00:50:45.84] It's one reason why-- it's something we talk about in my family a lot-- use local models for anything personal. Something I do in my practice, if I'm thinking through something that has any-- that could expose me in any way, I'm going to use a slow local model sitting on my computer. And one thing that-- a slogan we have in my lab is, friction is a teacher. The things that are hard, that corporations make hard for us, are often a reminder of how power flows.

[00:51:24.00] If it's hard to use a computer system that is private, that shouldn't be a reason not to do it. That should be a reason to recognize that somebody has an interest in seeing every thought that's running through our mind. And we need to resist this commodification of thought at all costs. That has to be an absolute bottom line for any relationship with this technology.

[00:51:49.60] HARRY SURDEN: Thank you. Dan, I want to turn to you. So I think one of the concerns we have is even if AI brings more benefits than risk-- which I am optimistic it will, looking at past technology trends-- the benefits are not evenly distributed. Certain groups of societies disproportionately bear the costs, and the benefits don't necessarily get widely shared, if not intentional. So can you say a little bit in law, ways we can nudge it down a positive path?

[00:52:23.07] DANIEL W. LINNA JR: Yeah. Well, I'm going to talk-- if I haven't upset any of the lawyers in the room yet-- I'm going to talk about lawyer protectionism. And I think some of the problems in this space. And, I do think these tools have tremendous potential for improving access to the law, access to justice, helping individuals understand their rights, understanding their obligations.

[00:52:42.41] And even before language models, we've seen that building expert systems, tools to help people. It's not a panacea, there's a lot of obstacles beyond even just building the systems. But there's legal aid organizations who are building tools. There are courts who are building tools. And I would argue, based on the experimentation I've done and the research I've seen, ChatGPT is better than nothing for individuals.

[00:53:06.03] And that's the choice for many individuals. They can't afford an attorney and they're not going to be able to get a legal aid attorney. Unfortunately though, there's a growing movement of lawyers and some judges creating a lot of obstacles to individuals getting access to these tools. One is unauthorized practice of law. And that's been playing out for a little while.

[00:53:24.43] But then, even one other piece of this is just some of the judge's policies in courtrooms. So disclosure policies. Some judges said, hey, if you use AI, you have to disclose, which creates a chilling effect on lawyers using it. And maybe also on self-represented litigants, although they're probably unlikely to be reading the standing orders of judges. Most lawyers probably aren't reading the standing orders, particularly the ones who are making big mistakes using these tools.

[00:53:49.11] But even more troubling to me is a handful of judges have purported to ban the use of these tools. I need to make more progress on a law review article that I've been wanting to write, but I think there's serious constitutional issues with that. Due process issues, First Amendment issues. I mean, absolutely, once you file something with the court, if the judge wants to sanction a self-represented litigant for hallucinated cases, they can do that. I think it's a bad look.

[00:54:11.19] More and more state judges are realizing that. But how can they dictate what you do in your own home, to do legal research and try to prevent yourself from being evicted, for example? So I think those policies are problematic. And then now we're starting to see unauthorized practice of law. Some jurisdictions wielding this as-- there's concern here about protecting consumers, absolutely. But unauthorized practice of law, we've seen some chipping away at the foundations of this.

[00:54:43.93] In the state of New York, there was this upsolve case that went up to the Second Circuit Court of Appeals, but it wasn't computer researched. But we see that you can see the pathway to unauthorized

practice of law, in my opinion, is going to go away. And it's overbroad. It's unclear what that means.

[00:55:02.19] And so what that means is not that you can do whatever you want and any AI provider can provide services to individuals, but that we'll need to think of different ways to regulate these systems. And if you want to provide legal services with an AI tool, does that just simply mean you need to register with the state? Is there going to be some sort of an audit?

[00:55:19.38] Different states are thinking about this. There's a sandbox in Utah. Arizona's been changing their rules. I spoke to people in the state of Maryland recently who are thinking about some of these questions. So we've got to think about proper ways to regulate. And I think in-- again, in a lot of ways, ChatGPT is better than nothing and we really going to tell people they can't use it.

[00:55:38.48] And I think this relates to-- just the last thing I'll say is-- law school policies. In the law school policies generally tend to be that, you can't use these tools. And it's, again, you can't enforce these policies because it's really unclear. I mean, you can't do a Google search because generative AI pops up at the top.

[00:55:56.22] But it's wrongheaded and it's really protecting faculty from thinking through, well, what does this mean? What are my students-- what do they need to learn in this class? How does AI change that? How can AI help in that space? But I think that we're doing a disservice to our students with some of the policies we have in law schools right now.

[00:56:14.30] HARRY SURDEN: I think it's a great point. I really like this. A lot of people know that in civil cases, like family matters or immigration, things like that, 80% of Americans can't afford or don't have access to a lawyer. So their next best option is basically, guessing. And as we know, the legal system is really complicated. So generative AI is at least better than guessing, if not as good as an actual lawyer.

[00:56:42.62] DANIEL W. LINNA JR: Well, especially the systems created by legal aid organizations. And then here's another area where it can be intentional. Support these legal aid organizations. Law schools partnering with them, try to improve funding for some of those initiatives.

[00:56:54.22] HARRY SURDEN: That's a great-- anyone else want to weigh in on how to be deliberate about making sure any benefits are widely shared?

[00:57:01.98] NATHAN SCHNEIDER: I just think it's really important that we not allow these tools to be an excuse to fail to create equitable systems of power and authority. I hear you in the sense of what's better than nothing. I don't know what the consequences of say, bad legal information as opposed to nothing. This is not something I've studied.

[00:57:26.22] We're seeing this in the medical context right now, where we've got a lot of bad information flowing out of, for instance, OpenAI products that could do a lot of harm. And also the line of accountability becomes nonexistent when you contrast this with human professionals, and that matters.

[00:57:48.98] I think we need to walk this line of making sure that-- I think there are a lot of spaces in our society. Health care is a profoundly unjust system in this society. And when we throw an AI at it and say, oh, well, maybe the AI will fix it, or we say, well, climate change is a big problem, maybe the AIs will fix that someday, this is a total withdrawal of responsibility.

[00:58:15.33] And that, again, is-- I think it comes back to that sovereignty question that you raised too, is like any time we are withdrawing our responsibility in any process that has consequences, that's a red flag about using AI well. We are not using AI well if we're taking a system that had some kind of accountability even if it was broken, and replacing it with a still broken system that just subtracts the accountability.

[00:58:45.05] HARRY SURDEN: Yeah, I think it's a great point. It lays bare that it's a social and political choice to not subsidize legal aid, to provide actual lawyers--

[00:58:54.09] NATHAN SCHNEIDER: --or to address climate change, or to have an equitable health care system. [LAUGHS]

[00:58:57.95] HARRY SURDEN: And like everything, it's a balance. Anyone else want to weigh in on the equitable question? All right. Well, we in our last 10 minutes, we want to open it up to the audience for questions. Per usual, we want to open it up to a student for our first question. And I see Max over here.

[00:59:20.81] AUDIENCE: Yeah. Thanks for the wonderful panel. Question on the context of using AI well in the education context in particular. I feel like we're so close to the moment with rising student loans, AI, and a lot of economic anxiety of people in Palo Alto saying, don't invest in college tuition saving for your kid. Buy them a Mac Mini and a cloud subscription. I can hear that.

[00:59:42.21] And I don't think-- I'm not saying I agree with that, but I don't think that's entirely unfounded. If the purpose of education is to skill people for the world, but you're giving them a blank chatbot LLM interface with no guidance on how to use it well, no structure, what's the benefit of people enrolling in higher education? What are the critical thinking skills that we can teach and structure around LLMs?

[01:00:06.29] At a superficial level, I've just given the analogy of, you open up in a school or corporation's like Office 365. They have templates for how a memo looks, things like that. How are ways that

maybe particularly education, can structure AI helpfully so that students aren't on their own?

[01:00:26.15] HARRY SURDEN: This is a great point, and thank you for bringing this up. And I will say the burden is on us, people like me, to think critically about this. To think how to give the students not just the specific skills which you were talking about, also more general skills so you can adapt whatever comes along, so you can be confident that however the future plays out, you have the higher level skills to thrive.

[01:00:55.03] SUSAN ADAMS: I think we're definitely at a transition point. Universities, Colleges, are really struggling to keep up with how do we transform ourselves. And the light is shining on the flawed assessments that we've been doing for decades. So I'm jumping out of bed every day as an instructional designer, curriculum strategist, excited, actually, that now we have the potential to make that change. But it is slow going.

[01:01:18.76] And so wanting to just double click on Daniel, around his process versus product approach to all of his assessments now, that's what we need to be seeing in the classrooms. And we are going to start seeing that. But what you're uncovering is outside society, outside of the walled garden, they don't trust that that is even happening. And they're in a place of anxiety and urgency, and it does make sense that that narrative is there. But that's where we're going to need to catch up. And I agree with you on our responsibility.

[01:01:51.56] DANIEL W. LINNA JR: I agree with Harry completely that it's the institution's responsibility, the individual instructor's responsibility. But students have a voice in this and a responsibility as well. And I think students should spend more time thinking about, hey, we're the customers, we're paying for this, what do we think and how should our voice be heard?

[01:02:09.00] But you also have a responsibility. And this is the top down, bottom up version of that. Hey, you're closest to thinking about what you want to do in your career, and we should be giving you the tools and helping train you.

[01:02:19.56] But you need to be investing some time in this also and thinking about, well, what other things should I learn? Where do I really want to go with this? How is this going to help me? How might it hinder my development? So I think there's a role for students in this as well.

[01:02:33.01] ALEXANDRA ROBINSON: I would like to take some of that onus off of students, I think there are other governments that are thinking about this way more proactively and that are actually modeling out the future of work and what types of within a job, what tasks are likely to be automated and subsumed by agents and what aren't. And are starting to think really proactively around how to prepare education systems and workforces for that future.

[01:02:57.84] And that is not on any one individual's onus to figure out because it is complex. It involves really, really spurious projections and scenario planning. But I think if our government isn't going to take that on because the priority is just selling and growing GDP today, then there are going to have to be bodies in the United States that fill that in and really shape education systems to support broader society and students, not just tomorrow, but in 10 years.

[01:03:39.78] NATHAN SCHNEIDER: Again, I'll come back to the point about the silver lining of the apocalypse of the college essay as being a bullshit detector. And it just takes me back to what is education about. I think Socrates, who didn't write a college essay once. Plato, who had to take notes.

[01:04:04.53] Also spent so much time talking about friendship, talking about the relationship-- and there's some kind of wacky stuff from maybe some of our perspectives in there. But, really emphasizes the sense that, the point of education is to develop right relationship, and knowledge and wisdom flow through that relationship.

[01:04:24.39] And it's not really about the information that you accumulate during that process matters, but the relationship is the heart of it. And this is in Confucius, and Paulo Freire, take your pick, relationship is at the heart. And I think to me that comes back to that question of what it means when your University imposes a corporate monopoly on you. Is that right relationship?

[01:04:49.89] The same day that that deal was announced here at CU, I got an email from BVST-- the school system where my kids go-- that they were banning it. They were banning ChatGPT from their network. That was-- I'm not saying that we want to necessarily ban it. But to say that what does right relationship look like?

[01:05:11.43] With these companies, how do we help people navigate a healthy relationship and relationship in which they have power, in which we are able to sit and work through the thorny questions together? To me, that's-- in some respects, this apocalypse has been an important reminder of that. To break some of the rote and to get back to basics.

[01:05:35.59] HARRY SURDEN: I've got a question right here, if we could get a microphone.

[01:05:38.81] SUSAN ADAMS: I think I got a microphone right over there for her.

[01:05:40.45] HARRY SURDEN: OK. We'll come to you afterwards.

[01:05:43.65] AUDIENCE: Thank you. Hi, I'm Molly. I'm a freshman in undergrad. And I have a question specifically about AI as not necessarily a replacement for human thought, but more like shifting the focus of AI as a cognitive prosthetic, specifically for students with learning disabilities or those from non-English speaking backgrounds.

How can we shift the focus to how AI can equalize the student experience, especially with students who have cerebral palsy and in the case of Eric Dane, I enable students to be able to be equally able in the classroom?

[01:06:27.04] SUSAN ADAMS: Well, you bring up a beautiful opportunity and that's that AI can absolutely become a collaborative tool for any mental existence. I'm really excited to see that possibility. I know it was a great story of a community college instructor who had a student who was on the spectrum. Walked in the class and said something entirely inappropriate, impulsive.

[01:06:55.66] Went back to AI that night and told them what had happened and got what should I do about it? And came back the next day and orated an apology and got a standing ovation. [LAUGHS] There was just, again, a collaborative opportunity there, and the faculty immediately-- and this was right when it came out-- centered the AI in the classroom and asked the students to say, was that OK? And when is it not OK? And brought them to the table.

[01:07:25.71] NATHAN SCHNEIDER: If I could just say, again, I think this is a case where we have to be really careful about using AI as a band-aid on unjust circumstances. And one thing I found as a teacher over the years is that working with students who experience different kinds of disabling things in a society that is not built for them, is that often the solutions are really social, and they're relational again.

[01:07:53.62] And that I think there are a lot of, hey, it's cool that we can have subtitles and things like that and I'm all for the prosthetic and the expansionary view of the human in many respects, but just let us not use this as an excuse to not do the hard work of figuring out how do we make inclusive social spaces. Inclusive spaces in terms of, how power is distributed and who and how we prioritize our attention and resources. I'll leave it there.

[01:08:27.86] HARRY SURDEN: Yeah. Excellent points and excellent question. And our final question is right here.

[01:08:38.08] AUDIENCE: You asked earlier, who's a lawyer and who's not a lawyer? Well, I was a public company co-founder, and I hired a ton of CU students. And I actually had four lawyers from CU reporting to me, and I did all the external law and all of that. And law was always at CU about educating for clerking and policy.

[01:09:09.49] I think we now have some business law, so I look at this from an employer. And as an employer today, any institution that did not educate students on how to use AI to improve the workplace would not be somebody I would hire. Period. And I've heard Todd, I'm also a CU trustee. And he's taught-- we've asked as trustees, what is CUs policy on AI within education?

[01:09:42.29] You talked about the court systems. How much does it cost for you to have somebody review a land use policy per hour? Lawyers are not affordable to most people. You guys are responsible for bridging that gap. And perhaps maybe legal rates go down and more people start to use lawyers, because they're using capabilities that allow them to process more things and work on more important stuff, instead of saying, oh, I have to do another distributor contract.

[01:10:21.23] And you're talking to your lawyer out of CU, who doesn't even know what a distributor contract is, or most favored nation clauses, or that you just did one last week. So I want to know what your aha moment would be, or was, that you went, wow, this is something I need to put into my practice, and this is something I need to teach to my students.

[01:10:49.08] HARRY SURDEN: Well, I'll just weigh in here. So I've been studying this for a long time. And I literally have my own benchmarks, where I test AI against various legal reasoning tests. And in simple terms, they went from bad, to good, to very good, over a very short period of time. And so that was my aha moment, seeing the AI being able to do tasks that for 20 years, it previously never could do.

[01:11:17.13] DANIEL W. LINNA JR: I think I was a lot more bullish on AI before-- well, than Harry was-- before the latest models come up. We're pretty much in the same page now. But even before these latest tools came out, there were a lot of opportunities to create rules driven systems. I mentioned technology systems review, but even the contract review tools were pretty darn good before Large Language Models came out, and now they're better.

[01:11:39.13] So I think that this is a really important point. And how are we going to-- it's not. When I talk about this, I mostly spoke about individuals, but there's a lot of small businesses and startups. And this goes to the Jevons paradox idea that Harry talked about earlier.

[01:11:57.34] A lot of lawyers are really threatened by this, but I think, yeah, there's tons of opportunities and it forces the lawyers and instructors, educators, to really think about, what is the value that a human lawyer really provides? And how does a machine supplement some of those things that the human lawyers are doing?

[01:12:14.24] I see lots of problems that are not being addressed in the world. I don't think lawyers should be afraid there's not opportunities to do things that are meaningful in society. But if they don't keep up with using these tools, I think they're more and more employers like you, who those are important questions to them. And we're not preparing our students properly if we don't address these things.

[01:12:32.98] HARRY SURDEN: Well, please join me in thanking my panel for a really thoughtful discussion here.

[01:12:38.20] [APPLAUSE]

Framing Remarks: Building a Data Infrastructure for the Future

https://youtu.be/n5tSR19HMrA

[00:00:00.00] MATT SCHMIT: All right, well, here goes. We'll keep us on schedule. Thanks again for joining us today and for sticking around for this afternoon's discussion. And I hope you all enjoyed the enthused lunch break upstairs. I heard the inspired conversation myself, and I have it on good word that it might have been the most enthusiasm we've seen at a midday break in a long time, and so that's great. I think it speaks to-- certainly not the emcee, maybe the topic. So thanks again, guys, for sticking around today.

[00:00:24.16] Now of course, we have a snowy day here in Boulder. And we saw a strong shift from in-person attendance today to remote. So if you're joining us remotely, thank you very much. Of course, today's proceedings will have a life of their own online after the fact. And so we encourage all of you here, if you're joining us remotely, to engage in that chat, and then if you're here remotely or in person, to engage with it after the fact. It'll be posted online on our website.

[00:00:48.02] We really want you to take this to your colleagues, your network. We're waiting into some new territory here at Silicon Flatirons. And we want to leverage your networks and your colleagues. Now, as noted this morning, the topic of data infrastructure, strictly speaking, is new to Silicon Flatirons. And I'm grateful that Professor Sterdan so graciously supported the topic and the idea to expand today's agenda to include this afternoon.

[00:01:10.75] Typically, we break for lunch, enthusiastic or not, and folks would have their own ways. But wait, today we're going to stick around for more. So as I mentioned again this morning, I'm new to this role. And my main priority is quite simple. I don't want to mess up a good thing. Stakeholders from academia, industry, not least the legal profession, if you look at our panels, policy wonks, entrepreneurs, and innovators and civically minded around Boulder in Colorado continue to look at Silicon Flatirons as a trusted space for informed, often expert discussion around the technology issues of the day.

[00:01:46.51] Well, I tend to think that this is a pretty hot topic here today. Now, given the incredible 25-year legacy, I couldn't possibly see both our annual flagship conference that wrapped up a month ago in February, and also today's annual AI conference passed us by without taking a preliminary look at the critical infrastructure that undergirds so much of what we do. Whether it's artificial intelligence as we saw today, telecommunications and platforms, spectrum and space policy,

yes, entrepreneurship and innovation. The topic of data infrastructure touches all of that. And those are areas where we spend a lot of our time. So this is the common denominator.

[00:02:26.62] Now, the historic investment and expansion in data infrastructure that we're currently experiencing binds all of that work together. And quite simply, it's driving our state and regional economies, likely keeping them on an overall growth trajectory. Of course, without this unprecedented investment in data infrastructure writ large, we'd likely be in the midst of economic recession nationally. Now, just because this topic is interesting, important, and interconnected with so much of the other stuff that we're doing and focused on, that's not necessarily reason enough for Silicon Flatirons to lean into the topic with all it's got.

[00:03:05.46] However, my gut tells me that this is a topic we should lean into and that this conversation is one that we can contribute to, however helpful. So that's the ask of the audience today, whether you're here in person or remotely, you're joining us after the fact. Think about what you hear. Weigh that against what you're seeing in the economy, in your local community, at your statehouse, and give us some advice. How should we engage in this topic moving forward? How do we get it right in our outreach and our programming in doing more in this area of data infrastructure?

[00:03:34.94] Now, since I am new to this role, another theme of today, I feel like I should take the right opportunities to introduce myself a little bit more. I'm not just this Minnesotan who transplanted to Boulder and end of story. There's 15 years of stories I could tell you. That's why I wrote it down, because there's a lot of tangents with this topic. So it seems like a good opportunity for me to tell you a little bit more about myself and how I found myself attracted to this topic, so here goes.

[00:03:59.45] For me, the idea of getting it right, or more appropriately, trying to get it right, it's been a through line throughout my professional career in various roles, whether as an academic researcher at the University of Minnesota, University of Illinois, a consultant, a one time state legislator in my home state of Minnesota, or a recent state technology official. The through line, trying to get these technology questions right.

[00:04:22.97] Now as an academic researcher, one of my early projects was making sense of the now 30-year-old Telecommunications Act of 1996. I was dealing with it like a decade after the fact, but nonetheless, it does date me a little bit. And I was intent on translating its opportunities, its restraints, the resulting playing field for local communities, for providers, for tech firms, for policymakers. Now, mind you, again, that was a decade after the bill passed, but still a while ago.

[00:04:49.37] Now as I transitioned into a consultant role during the aura era of the 2009-2010, huge investment in infrastructure and in

telecommunications infrastructure. I had the chance to work with local governments that were interested in building out their broadband infrastructure, data centers, and co-location facilities where the talk of the day. And then in 2013, I had a chance to take that experience to the Minnesota State Senate. And as a legislator, among my tech themed interests, authorizing state tax incentives to spur data center investment, sounded like a hot topic in 2013, and well, it's hasn't gone away.

[00:05:26.20] And so, of course, I tried to do the right thing when I was in that role and also make sure that I wasn't doing two things at once. So for the record, I was not consulting while I was creating a tax incentives for data centers. It was one or the other. I retired from that consultant role, and then when I was unceremoniously retired from state office, I tried to unretire that consultant role. So it was one or the other. Never both at once. But that's a story for another day. That 2016 election, let me tell you.

[00:05:54.27] So in all those roles, I've been interested in exploring how data infrastructure writ large contributes to local innovation ecosystems and supports related startups, suppliers, tech-based businesses, the whole gamut. In short, how does this infrastructure contribute to competitive economies, whether they're at the local, state, regional, or national levels? I don't want to overstate this work, but it's been an interest, guys.

[00:06:19.11] And so I think that's one theme of this afternoon, the mounting pressure to invest, to expand, to incent, and to build out, all in an effort to be competitive in this wildly changing, 21st century, tech-driven economic landscape that we find ourselves in. So how do we support local communities, other stakeholders in the face of that pressure?

[00:06:42.55] Now, in all those roles I enjoyed back in the day, I saw local governments tend to struggle with how to approach a new, relatively complicated and certainly relatively technical issue. Data centers, broadband build outs, co-location facilities. Things have changed a lot since then, but nonetheless, I see that struggle continue in some cases. And in those 15 years since then, the issue has become considerably more urgent, it seems, if not complex. And both the local and state governments that often struggle then, might continue to struggle today. Or at least they might struggle in how to approach the ask, the opportunity, or the obligation that's before them, especially when you weigh it in front of all of the other agenda items before a state or local body.

[00:07:26.86] Now, just as we saw states race to create incentives a decade ago, we're once again seeing states reconsider, restructure or reverse course on some of those development tools. However, state, and local governments remain at the forefront of regulating, permitting, and incentivizing today's data infrastructure and its

expansion throughout the country with some of those state and local decisions contributing to our national data infrastructure, capacity, distribution, competitiveness, and strategy, if that's what you want to call it.

[00:07:59.13] So this seems like a good topic for us to explore here at Silicon Flatirons. And in setting the stage here, perhaps I've overstated the urgency of the moment a little bit, but I suspect not. Perhaps what we'll see is that the path forward isn't wrought with hyperbolic promise or doomsday peril, but rather a careful, measured, and thoughtful consideration of the trade offs, the right sizing, the right locating, and the transparency that's needed to get it right. I guess we'll see.

[00:08:28.13] Now, just as Silicon Flatirons is trying to get it right when it comes to taking on a new topic such as this, for our panels this afternoon, the question is similar. How do we as state and local policy makers, investors, industries, and informed citizens put ourselves in a position to get this historic investment and expansion and all that brings, how do we get that right? So, for better or worse, we've loosely organized the afternoon panels into two sides of the formula to build a data infrastructure for the future.

[00:08:59.29] On the demand side of the equation, if you will, we welcome perspectives from real estate and land use, critical infrastructure, energy, broadband connectivity, and not least local private sector investment. Altogether, our first panel will speak to various demand side factors, from hyperscalers to edge capacity and those everywhere in between, driving the historic investment in data infrastructure and in particular, data center expansion.

[00:09:24.25] Now, on the supply side of the loosely fitting equation that we've established here or I've established here, for better or worse, we'll hear from perspectives reflecting state and local regulation, energy production, and public interests concerning energy consumption, land and water use. Our second panel, we'll bring to life various considerations that either balance out, push against, or support that data center and data infrastructure expansion.

[00:09:50.44] Now, at the end of the day, we're going to open the floor to cross-cutting discussion that we hope spills into Bettcher Hall right next door for our afternoon social reception. And throughout the proceedings today, we'll do our best to capture the conversation and then report back to you on next steps, what we heard, where we might go from here. And so, once again, without further ado, don't let me stand in the way of a great agenda that we've put together for you today. I'd like to invite Maddi up to the podium to introduce our next panel. Thank you.

Panel 3: The Demand Side of Big Data

https://youtu.be/n5tSR19HMrA

[00:10:24.60] MADDI CASTELLANO: Good afternoon, everyone. My name is Maddi Castellano. I am a second year law student here and also the current president of Silicon Flatirons' student group. I am pleased to introduce this panel on the demand side of big data. Our moderator today is David Reed, a senior research associate at CU and a senior fellow of the spectrum policy initiative. Joining him as panelists are Jeff Casey, a director at Burns McDonnell, Gordon Dolven, director of data center research at CBRE, Casey Lide, partner at Keller and Hek'ma, and Jason Schwent, member at Clark Hill PLC. Please join me in welcoming them.

[00:11:06.92] [APPLAUSE]

[00:11:10.59] DAVID REED: Thank you, Maddi. I appreciate it. So good afternoon. I want to welcome you to this session on the demand side of big data. I am a engineer, and demand is an economics term in issue. But we're going to dig deep here on the question of how this demand dramatic increase in computing demand is pushing data center investment and resource consumption.

[00:11:43.70] So over the past two years, the conversation around AI has moved very quickly from the algorithms and applications to something much more physical infrastructure. My background in broadband and some of the others on the panel, we're quite comfortable in talking about infrastructure, but this is a new player, a new piece on the chessboard.

[00:12:07.78] So what we are seeing now is that the rapid expansion of AI, cloud computing and digital services is driving an equally rapid expansion in data infrastructure, particularly data centers, fiber connectivity, and the power systems required to support them. In many ways, the digital economy is revealing itself to be deeply dependent on very traditional forms of infrastructure to meet the demand. Land, energy, networks and capital investment.

[00:12:42.41] The scale of this moment is striking, with over-- I went to a source that was from late last year-- $1.5 trillion committed over four years from the US high tech sector alone in this space. Across the US, and by the way, if you compare that to how much is being spent on broadband, it's already exceeding of what a lot of what's been done on broadband, so this is a significant investment.

[00:13:13.97] Across the US and globally, we are seeing unprecedented demand for new data center capacity. That demand is being driven by a range of forces, hyperscale, cloud providers, the

continued growth of streaming, gaming, and other high bandwidth applications, and of course, AI model training and inference.

[00:13:33.69] What was once viewed as relatively least specialized part of the technology ecosystem is now emerging as a core component of the national critical infrastructure. But with this expansion comes a set of questions that reach well beyond the technology sector. Communities are beginning to grapple with issues like land use, water consumption, and energy demand associated with the large scale data center development.

[00:14:00.20] Electric utilities are confronting what may be one of the most significant new sources of electricity demand or supply, as we may talk about, in decades. At the same time, policymakers, investors and infrastructure planners are trying to determine whether the current surge represents a sustained structural shift in the digital economy or whether some of the investment may be running ahead of long-term demand.

[00:14:25.52] In other words, the question is not just how fast data infrastructure will grow, but how we manage that growth responsibly and strategically. That is exactly what we hope to explore in this discussion. As Matt just noted, we have an excellent panel with us today to discuss these issues. Together they bring a practical, interdisciplinary understanding of how these projects actually get planned, financed, permitted, and built.

[00:14:53.56] Our panelists have been introduced earlier by Maddi. What I'll do now is I'll ask each panelists to briefly introduce themselves and share how they came to work on issues related to data infrastructure and data center development. So, Casey, let's start with you. And then we'll just work our way down.

[00:15:11.44] CASEY LIDE: All right. My name is Casey Lide. I'm an attorney in with Keller and Hek'ma in the communications and practice-- excuse me, communications and technology practice group. I'm based in DC, but we have a Boulder office, and I'm glad to have had the chance to come out here and hang out with my friends in the Boulder office a little bit.

[00:15:29.00] I'm here on the broadband infrastructure side of things. Our practice group has a broad communications practice, everything from fiber deals to spectrum licensing, pole attachments, and then up the stack a little bit to privacy and copyright and things like that. But my focus has tended to be on infrastructure over my career.

[00:15:53.87] And we've seen a number of cycles happen on the demand side, especially with fiber dating back to, as Matt said, in the 2010 frame with Aura and Btop. And we're at a really interesting place right now. And we'll get into specifics in a little bit. But from a supply perspective, we're a lot of attention is being put on what's called the middle mile in connecting data centers. At the same time, there's a lot

of attention from a policy and funding perspective also being put on the last mile, reaching residences and businesses who just use broadband.

[00:16:30.90] So you have these two things happening at the same time and burgeoning growth happening at the same time. And as we'll talk about in a little bit, the scale of the growth, particularly between data centers, connecting data centers to each other, getting the information out of the data center for AI purposes is something that I don't think the industry has really ever seen before.

[00:16:52.54] DAVID REED: Jason?

[00:16:53.02] JASON SCHWENT: Thanks, Casey. My name is Jason Schwent. I'm a member with the law firm of Clark Hill. We have offices in Denver and Boulder. My practice, I'm focused in the Cybersecurity and data privacy group. My work in this space has largely been in advising my clients with respect to risks, in adopting AI technology and rolling it out and advising with respect to in counseling with respect to their adoption and work in this space. As it relates to the infrastructure, those things are fairly closely related as we've been hearing. And we will hear more about. That adoption is something that we have a lot of predictions, and we have a lot of thoughts on where that's going to go. But in terms of actual real data, with respect to that adoption, a lot of that data is still out and we're still waiting to see where that's going to be.

[00:17:47.15] And so in counseling my clients and then looking at the risks involved in the adoption of AI technology, one of the things that we do consider is what is the market going to look like in 5, 10, 15 years. The types of investment we're looking at. We're not talking about small amounts of money, small amounts of energy, small amounts of land that that's going to be committed to this. And as Casey had mentioned, there's a lot of places to invest when it comes to this technology.

[00:18:19.01] Is the investment in data centers is the right place to be investing or is it better spent elsewhere? But hopefully, we'll be having a discussion along those lines. And yeah, I think it should be interesting.

[00:18:32.56] JEFF CASEY: I'm Jeff Casey, Director at Burns. McDonald focused on designing and building critical infrastructure. Burns Macdonald is an employee owned company. 128 year history of serving clean water and reliable power for utilities. Of course, we've spread out dramatically from our roots today. We fundamentally touch all of the systems that are necessary to make communities thrive. So anything necessary you're going to build a community from the ground up would be the infrastructure that we design and build.

[00:19:03.62] We're the largest in power and second largest in telecom and data centers. And so how did I arrive at this moment I

think was the nature of the question. I'll give you both a personal story and a professional story. Personal story. My dad started a communications business in the 80s and 90s, which was an odd time to be in the communications sector because you could be on the wrong side of a bubble, which I think will probably hint at today, but not talk about the other half of my family. My grandfather and my uncle built coal fired power plants and managed coal fired power plants. All three of them thought you should go into engineering and do what I do. And I said, no, I'm going to do something completely different.

[00:19:38.71] Little did I know 20 years later I'm working at the nexus of power and data. And so really, joke's on me for not listening to them much sooner. I have a unique role at Burns MacDonald. I have an engineering background, but I actually sit on a small team that focuses on solving client's most toughest challenges, and that's coming up with creative or novel commercial solutions for those challenges. That could be investing in infrastructure, developing infrastructure that could be investing alongside of our clients and what they're trying to accomplish, and that could be developing new products and services or solutions for what our clients are going through right now.

[00:20:13.65] And some of that's the advisory side, some 0 that's helping them on simple design things and other things is bringing that infrastructure to life. I've been at Burns McDonnell my entire career, 18 years and have held a number of different roles from large programs, major projects, telecom technology development, and now the role I'm in today.

[00:20:33.39] DAVID REED: Awesome. Well done, Jeff.

[00:20:35.43] GORDON DOLVEN: My name is Gordon Dalvin. I'm based in Denver. I work at CBRE, the commercial real estate company, and I cover data center research for North America. What does data center research mean. It can mean a lot of different things. I track supply, demand, construction, absorption, pricing, all those same types of metrics that you would assume you would want to track for office, industrial, retail, multifamily, traditional asset classes.

[00:21:02.83] But in terms of a differentiator, I truly believe this is digital infrastructure, not just digital real estate. This truly is mission critical types of infrastructure that we use every day, whether it's personally or professionally. I want to thank Matt for bringing me in and for leading this conference and this discussion as well.

[00:21:23.40] How did I get here? I came out of school and I was actually in financial services, and I was banging my head against the wall trying to sell wealth management products to people who had no interest talking to a 22-year-old whatsoever. And I thought, what is a disruptor that I could get behind in terms of something that can change that type of industry? And it truly was the automation and the technology that's providing all of these products and services today,

which is backed by data centers, fiber, cell towers, all the digital infrastructure that we use. So happy to be here. And thanks for having me.

[00:22:00.26] MADDI CASTELLANO: right. Well, I'm going to keep it down there with you, Gordon, with this next question, since you have a great passion and focus on digital infrastructure. So where do you think this is going in terms of realistic, immediate, and sustained growth in data center expansion, or what are the likely impacts on things like land use or other factors that maybe are of significance?

[00:22:25.79] GORDON DOLVEN: Yeah, if we all had a crystal ball, we'd be out of this room doing something else. But I think on the demand side is where I want to focus. I think maybe we go back in time and just talk about how we got here. So I think about the origins of data centers and why you actually need data centers. I don't know if everyone remembers back in the day, every office and every company within that office building had their own IT closet. And that's where you stored all your files, all your emails, all your documents.

[00:22:53.25] This is back in the day when maybe you used a fax machine. Maybe you were using your printer on a daily basis. Well, now, instead of every single company having their own mini data center in every single floor of every office building in America, we're now able to commingle those assets and to share them under one roof in a data center.

[00:23:10.73] So the joke is that the cloud has four walls truly has a meaning to me. The cloud is not some esoteric destination for all of us to travel to every time we use our smartphone. No, the cloud sits in a data center and the servers within a data center. So if you go back to why we were using data centers in the past, it was simply to send emails. It was to do web search. It was to use very, very much internet 1.0 types of tasks. And then we formulated the social media types of applications that started on our smartphones.

[00:23:45.02] So if anyone remembers, Facebook was first launched across universities and campuses. And they were a huge demand driver for servers. And everyone thought, why do you need servers for a dating website? Like, are all these kids really using that much server space to just talk to each other? But in actuality, it became a social media network and a fabric for people to share content, to upload content, to communicate with each other.

[00:24:08.14] And then we got into streaming services. So instead of absorbing information through over the top television or through traditional ways of getting content. You can now stream things, and then it's evolved over time into these applications that live and breathe on our devices, either personally or professionally. And now where we are today, which is at this inflection point in terms of AI adoption. So I think it's truly a matter of if you continue to get more productivity, and

if these tools continue to help you, then you will adopt them and utilize them more.

[00:24:44.07] And in my personal opinion, that will only continue as the technology and the use cases continue to grow within our professional lives. So that's where the demand is right now. It's scattered across all fortune 500 companies adopting AI tools internally. The data has to go somewhere. And I think a demand wave that we have to really be keen on focusing in on is that certain workloads are not meant to just sit on the public cloud, certain workloads a company wants to have internally on their own servers, either for data protection, data privacy, or from a competitive reason. But I do think the demand is coming from not only the cloud, but also from on premises enterprise co-location servers. It's a way that really touches all ecosystems of the data center industry.

[00:25:31.82] DAVID REED: So it's interesting that you mentioned Facebook or Meta now, that they were early on, in terms of establishing their own data centers and committed link to that, their own backbones. And so the notion of a public cloud versus a private cloud emerged because Meta and Microsoft and a lot of the big tech kind of took the data centers and connecting to them for what they said were the need for managing their subscriber quality of service, because they could control it.

[00:26:14.38] And so that you've got now several private networks that with basically the data centers being key components of that. And do you think that has any implications going forward for-- I mean, you mentioned public network, that's why I'm-- where does the public network swim among all these large private networks that are basically anchored by large data centers? And yeah. And I know--

[00:26:47.90] GORDON DOLVEN: I think every industry and every company will approach this differently. Like the typical demand drivers were from the technology companies, which we talked about, the financial services companies, very data intensive in terms of what they do and what the products they offer to everyone here and then the health companies in terms of data security. But just thinking about the future in terms of any company doing research and development, any company trying to optimize or more efficiently build a new product or service in the R&D side.

[00:27:13.71] Building tools and making sure those trade secrets are kept internal. I truly think that is where the public, or the private AI or the AI demand wave will continue to rise. It's not necessarily, in my opinion, something that may be forced from a regulatory perspective. It could be a focus of a c-suite perspective or a board of director perspective. So as these companies become more defensive in terms of cybersecurity risk or from trade secrets getting out, I truly see that as helping the private Infrastructure and build out of this entire wave.

[00:27:50.05] DAVID REED: On the public side, we had companies like Equinix that had an internet exchange point and XP. Sorry, guys, I told you I was an engineer, but trying to explain some of how this infrastructure is evolving. And part of their business model was to have an internet exchange appearing point, but also to have a data center sitting next to that, that if you weren't a big player like Meta, you might be able to still have support in the cloud for your services. I don't know if anybody else on the panel here wants to jump in on--

[00:28:30.20] JASON SCHWENT: Yeah, I mean I think the note about the cybersecurity concerns, the privacy concerns, the IP concerns, quite frankly, I think that is going to be a significant driver with respect to this demand. I think those aspects of things I don't know that regulations necessarily going to drive it. I think you're right that I think other commercial factors are going to push that. I mean, we're already seeing there was a case this month where the use of AI can waive your attorney/client privilege.

[00:28:57.52] Now, that's not necessarily going to affect demand necessarily, but I think those sort of decisions in an area where we have a lot of assumptions about how things are going to proceed and about how things are going to work and how this technology is going to be adopted. But I think there still are these aspects of the law and with other commercial considerations that we don't really know how they're going to play out yet. And I think they're going to have a significant impact on a lot of this.

[00:29:24.35] I also think there is a bit of a chicken and the egg sort of argument and scenario at play where if you have a bunch of supply on one side, where you have a lot of this infrastructure there, then people will find if it's cheap enough and if you've got an abundance of it, then there will be a use for that people will find a use for it.

[00:29:44.85] If there isn't, there may be alternative technologies that are developed to handle that sort of thing. I mean, we talked about with television distribution. That was handled entirely different 25 years ago. It is an entirely different model, based largely on the fact that there was this sort of broadband capability that was out there. Other technologies may be developed, or there may be other solutions that may be better for certain industries that won't necessarily use the data center or that sort of backbone to develop that we don't know about, which is where I think there is still a lot of uncertainty.

[00:30:19.48] I know there's a lot of investor talk about where this is going to go and in terms of where markets are going to be and in terms of what sales goals are going to be hit, the reality that hasn't necessarily developed. And I think there's a host of factors affecting that. And I think it's more than just whether or not there are servers in a building with power to drive that.

[00:30:42.84] I think there's a lot of other things that are going to come into play that I think as usual. I mean, these same sort of issues we talked about a lot of these when the internet was first started being commercialized. There was a lot of uncertainty in terms of where that was going to go, and there was a lot of thoughts in terms of what we're going to need to make that work. Some of those panned out, some of those did not. And so I think we're probably going to be seeing a similar thing with a lot of this development.

[00:31:08.07] But that's why I am still-- I firmly believe there's a lot of uncertainty here. I think there is a need for a lot of this bandwidth and a lot of this supply side. But I think there can also be if you produce a lot of it, then there will be people who will use it. And I mean, that's always been the case.

[00:31:28.31] CASEY LIDE: I think we're in a very different place than we were 10 years ago, not just in terms of the magnitude of the investment, but things were more-- I want to oversimplify this. There was a more egalitarian approach or a more of a democratized approach to all of this. A few years ago, using the Equinix example. A neutral host site, effectively, somebody could come in and stand something up in Equinix and they're still there.

[00:31:51.13] But the investment is going is being made by a handful, by and large, by a handful of entities who are plowing vast amounts of money into gigantic data center complexes and buying vast amounts of fiber to connect them, and they control it. They may have a vast amount of fiber, connecting them, a huge supply, connecting these data centers. They may not even be using it all. There may be a ton of excess fiber available, but they may not make that available to others because they invested it, and they control it. So that's very different than supply just generally being available.

[00:32:23.51] JEFF CASEY: The only thing I would add is the optimist side of me would say, we didn't understand what the iPhone would do until the App Store was there. The App Store enabled a new economy and things like Uber, which we never would have had if we didn't have the underlying infrastructure to support it. So do I think that's going to come from here? No, we'll probably have a lot of losers before we get to an upside case of meta controlling the rails, for example, of an app store for AI. A lot of predictions show what that will or won't look like. I think nobody knows today.

[00:32:51.51] But if we go back just a decade or two decades, we couldn't paint the world that we see today as it is. So I think it's fair to think like, hey, we have five companies controlling the rails. In many industries, it's like that. And the question is, how does that get used and how does that get monetized and who benefits. And maybe the downside is who do we need to protect from policy or regulation standpoint.

[00:33:12.60] DAVID REED: Well, Jeff, let me stay with you. Since you've spent a lot of your career supporting the expansion of critical infrastructure. So how does the data center, boom, if we use that term, compare? I've have called it a bubble. But any observations as well on the energy component on the demand side of the equation?

[00:33:33.00] JEFF CASEY: Yeah. It is the largest or the most capital intensive deployment of infrastructure broadly that we've ever seen as a society. And I'll put that in context. That's not hyperbole, that's real world, what's going into the ground. And the impacts to that and the externalities to that are crazy. But maybe if we backed up and said, have we observed it before? I think that was your first question in the energy sector. Yes. Electrification, post-war, we had 2 and 1/2 to 3% load growth, cloud incredible amounts of capital into the ground to build the electric system.

[00:34:07.75] '60s, '70s, '80s, '90s did it again through coal and natural gas generation. Again, 2 and 1/2 3% load growth again plowed an incredible amount of infrastructure into the ground to support the grid. The modern grid that we have today, that's both generation and T&E assets. But if we back up to pure demand and the underlying demand attributes that exist, we shouldn't take for granted that AI is the fastest adopted technology, faster than cell phones, faster than the internet, faster than TikTok, three months to 100 million users. First technology to have a billion users in a year.

[00:34:40.39] I think I saw a number 800 million monthly users. That's not people subscribing yet, but that's an incredible amount of use. It's an underlying signal or sign that something is happening, that there's a groundswell there. I think that's really incredible. And we shouldn't forget that. I think we also need to think as we talk about the various types of data centers. Historically, we talked about a data center that had a rack, a 19-inch rack that was 5 to 15kw. We're talking about the load of a couple of houses.

[00:35:07.78] We quickly went to 20 to 40kw. Now we're talking about an EV charger, a DC fast charger on the low end and then some of the frontier racks. Again, we're talking 19 inches of floor space. We're talking 300kw to some of the predictions for electricity consumption. We're now talking the production line and a manufacturing facility. We're talking about two to three city blocks of electricity simply to serve a single rack.

[00:35:34.06] The size of infrastructure that you need to build then to support that because it is also, I'll say, a land grab. You want to get the permitting, you want to get your grid connection, you want to get your water rights. You want to get all of the things necessary to serve this done. And you want to buy the land once. You don't want to go back. Results in some of the largest data centers being 5 to 10mi. That is incredible. We're talking 1,000,000ft under a roof, and we're talking 30,000 to 40,000 racks.

[00:35:57.95] So if you play in the top end of a frontier rack, you say 30,000 of those in a data center. Now we're talking about a medium sized city worth of load in 1,000,000ft And so then we take that one step further into the world that I work in, I've been in the electric utility industry for 18 years. We've had 0% load growth for 18 years. And almost every year we've had record levels of investment.

[00:36:21.85] When I started in the industry, I think we were around $80 billion of investment in the T and D and generation sector. Fast forward to 2015, we're around $105 billion. Now projections this year suggest $220 billion of investment, like unprecedented amount of investment into the electric grid to support this. And I think the challenge is that takes away from everything else that was already happening.

[00:36:44.19] Utilities weren't attracting always the best talent to work for them. They weren't overstaffed, looking for things to do. We had an incredible amount of work in front of us prior to that need. So going from flat load to some load growth, predictions 2% to 4%. To put that into perspective, 2% to 4% we're talking about doubling the size of the power grid by 2050.

[00:37:09.24] Can't fathom that. Like in my lifetime, if you would have said, we're going to double the size of the power grid, and we're going to add 1 to 2000 terawatt hours of generation to our system while-- and we heard on the panel yesterday-- while data centers may take up 12% to 14% of that total generated asset, that's an incredible amount of investment and infrastructure that goes into the ground.

[00:37:32.12] And so my final mark remarks here would put this into context. So if we bring all of the major investments that have happened in our country to present value, and we look at them through the lens of today, we're talking about the capital intensity of the telecom sector, that total build over 20 years, happening every two to three years for data centers.

[00:37:52.72] We talk about the highway system built over 25 years I think. We're talking about that happening every one to two years like this. This is unfathomable to me. Like we're building an interstate highway system every year. If you talk about the generation system of 40 years of investment and generation, we're doing that two to three times over in a single planning cycle. And the rail build out again, equivalent to that from the 1800s, every couple of years.

[00:38:17.98] And so the only thing that I can equate this to is the Industrial Revolution, which took 80 years, 80 years to put $5 trillion worth of infrastructure and equipment and machinery and factories into our economy. 80 years. We're talking about doing that amount of investment in 5 to 10. So the speed and intensity of this is incredible, and it touches every part of our society and our economy, manufacturing power generation and telecom workers like this is the

most incredible investment opportunity or risk that our country probably has ever seen. So that was a long answer to a simple question. It's a yes and.

[00:38:56.07] DAVID REED: That's a great answer. I guess, is the demand differentiated enough for some of these different players that are major investors, Apple versus Google or with search versus what Apple wants for the smartphones and their AI that we might see a lot of? I know we're not the supply side, but just different experimentation, so to speak, on how to get that.

[00:39:27.27] JEFF CASEY: How to get access to the grid?

[00:39:29.47] DAVID REED: Well, both the grid as well as having enough thrust behind being able to do the inference for their AI because you've got Facebook or Meta that's out in front on the open compute project for them, which is really kind of customizing, how they want their data center servers to work. Elon Musk wants to put it up in space. And the question is, are they all dealing with the same requirements, so to speak, of latency. Because the applications they're supporting or are all about the same. Or can SpaceX tolerate some latency with satellite links and therefore kind of have different solutions there and a different approach to making it work?

[00:40:27.30] JEFF CASEY: I'll start by saying they're all optimizing towards the same scarce resources of power, land, water, and fiber. Everybody is optimizing towards those four attributes. And everything after that is a tradeoff decision that you're making to serve your need and your optimizing around that. And when we talk about data centers being an arms race of competition, it's typically competing across County lines, state lines, utility boundary lines, competing across where I can get land, where I can get an option on land where I can get access to water, how I can play two utilities against each other, how I can apply for the same grid connection for the same load. They may also have a developer or an SPV that's chasing the same opportunity below that.

[00:41:17.93] And so I think we're still in the role of consumption and optimizing everything that's out there until there's scarcity in one of those assets, which scarcity and Gen connections happened substantially faster than I think I probably would have predicted. Maybe that was naivety on my part, but I remember hearing some of the digital infrastructure investment leads saying, oh, we're 2 to three years out from transmission capacity.

[00:41:45.34] Then after that, two to three years out and we've consumed all of that. Today, 23% of utilities say 100% of their capacity is being requested for data centers. So implied doubling the size of the grid. But I don't think differentiating the type of inference, say, Meta versus Oracle is doing is the important thing. I think it's separating, is it cloud and storage, is it training and inference, or is it an enterprise

load? That is how you differentiate the size, the scale, the location, the needs of those assets, is meta versus space doing something different.

[00:42:25.58] Yes, they have different requirements, but probably not as dramatic as is it a cloud, is it colo, is it built to suit, or is it a hyperscaler.

[00:42:35.54] DAVID REED: And one more follow up since we are talking a little bit about energy here. To the extent to which there's been the proposal by the current administration allowing big tech to basically build their own power sources, you think that is going to play a potential major role in being able to meet some of the timelines that you were talking about earlier? How--

[00:43:00.43] JEFF CASEY: Yeah, we're talking about seconds to download an app and to have a search query that is equivalent to a light bulb. And we're talking like on one side and on the other side, we're talking about 7 to 10 years to build real assets and real infrastructure. And so there's definitely friction and a mismatch. And what we're seeing is everything, every single strategy that you could imagine to get access to either TND resources or generation resources is on the table.

[00:43:24.75] Developing it yourself, applying for grid connections, applying for competing connections for the same need across state lines, utility lines, et cetera. Buying developers, buying generation, developing behind the meter, bridge to grid while I wait. Fully self-supporting 10 gigawatts of nuclear, like maybe coming back online or being used just to serve data centers. I mean, every single strategy that you could possibly think of is in play here.

[00:43:52.47] Do I think behind the meter long term data center served only by generation that they own is the solution? No, probably not. It is really hard to build a reliable generation and transmission and distribution grid. So I believe that is a temporary solution while they wait for capacity on the grid.

[00:44:14.35] JASON SCHWENT: I guess I'm still the question I come back to or the issue I come back to is that with a lot of these, particularly, AI is clearly driving a lot of the need for this data center space. And the question I come back to is that, with a lot of these AI companies, they are going to need the infrastructure that Jeff's been talking about, that in order to be profitable, they have to be at this unheard of level of growth and infrastructure in order to be successful as companies. They're betting that they're going to get there, and they've sold a lot of the development of this infrastructure on the promise that they will get there, and without any results to back that up necessarily yet.

[00:44:59.86] And all of it is dependent upon them getting there and it being successful and profitable at some point in the future. So we have to build this enormous, unheard of amount of infrastructure in order for

them to be profitable. And then, we will see the results of all this really happen.

[00:45:19.86] When the technology and its development is not-- the early results in terms of adopters have-- the results have been mixed at best in terms of people and the results that they're getting. So there's this heavy, heavy bet on all of this infrastructure, massive amounts of infrastructure being built, and as Casey noted, being owned by these private companies in large measures as opposed to necessarily some of the infrastructure you were talking about, Jeff, in the past, where they were publicly owned, where these were public utilities that were open to the public, and therefore anyone could use it. This is mostly private development that's being funded on the hopes of profit in the future.

[00:46:02.01] And if any of that falters or any of that doesn't develop or doesn't come about, what are we doing with all of this infrastructure that's being held by private companies that may have zero value? And that is a big question. And I think, as far as regulation, as far as the thoughtful development of this infrastructure, is there a downside to having too much of the infrastructure?

[00:46:25.07] I think past history has shown that when you have-- at least when it comes to internet and bandwidth, if you have it, people will use it and will exceed it. It gets used up. There's a use for it. But again, that was largely public in terms of its development and the way it's been used. As Casey noted, this is more of a private development.

[00:46:43.40] So how does an over development in that private space translate to public benefit if those companies can't turn a profit, if the profit doesn't materialize? They promise it will, and they promise that it's going to come. And they promise that if we have all of this infrastructure, and we have this giant capability, then the AI will be really good, and it will be that much better, and everybody will benefit from it. Trust us, we'll get there.

[00:47:11.34] JEFF CASEY: Can I give you an answer, Jason?

[00:47:12.42] JASON SCHWENT: Yea. No, yeah.

[00:47:13.94] JEFF CASEY: History would tell us that as a society, we will bail out shareholders.

[00:47:19.10] [LAUGHTER]

[00:47:20.32] And we will-- and we will allow the common person to be harmed. We have had that happen many, many times. And we will probably repeat that bad cycle if this scenario plays out that he described. That is probably the unfortunate truth.

[00:47:37.33] JASON SCHWENT: Yeah, that's fair. Yeah.

[00:47:39.39] JEFF CASEY: We bail out shareholders. We do not bail out citizens.

[00:47:43.76] DAVID REED: Well, Jason, let me--

[00:47:45.73] JASON SCHWENT: No, no, no, no.

[00:47:47.31] JEFF CASEY: To the bar.

[00:47:48.17] JASON SCHWENT: No, no exactly. No. Excellent point. No, that is history. Yeah.

[00:47:53.01] DAVID REED: Let me keep it with you. And given your experience with the local companies and how they're approaching this moment-- and you mentioned some about risk here-- but what are your observations on this?

[00:48:04.65] JASON SCHWENT: Yeah. I mean, I think there is a wide appetite for a lot of this technology. I think that is an unmistakable. And Jeff, you cited a lot of the statistics in terms of adoption, in terms of people moving into this space. I think there is a healthy appetite for a lot of this technology. As a lawyer viewing a lot of this, I see some of that appetite exceeding the thoughts given to the risks associated with it.

[00:48:36.34] From my side of things, there is a lot of concern. And Gordon, you mentioned it, too, in terms of privacy, IP, those sort of concerns in the use of AI, particularly where you're using AI that is not segregated. That segregation requires an investment in that sort of infrastructure that we're talking about so that you can keep your data separate from everybody else who's using the AI.

[00:49:02.70] And I see attention from a lot of the executives that I work with where they want this technology because of the promise of what it's going to bring-- lower labor costs, lower costs in terms of developments, faster development. They want all of that. But then when faced with a lot of the risks that come with it, then they start to back off of some of It.

[00:49:25.04] And I've seen with some early adopters even, that as the technology's rolled out, they found problems with it. And they've backed off then in terms of its adoption. It hasn't panned out necessarily in their development. It hasn't panned out the way that they had hoped.

[00:49:40.14] And that is where I get a lot of this concern in terms of, is this trend going to continue? Or are we going to see these sort of-- it's not really getting us where we want to be, so maybe this isn't the best place for us to sync all of our money and all of our development. That's the appetite and the tension that I'm seeing with a lot of my clients in terms of adopting a lot of this technology, that it's a bit of a mixed bag, that where some limited uses of it can be of benefit to the company. They can be of benefit to production timelines in terms of labor

savings, but it comes usually with a trade-off in terms of additional risks that they're taking on because of errors, because of problems with the data that they're using, because of problems with the data being shared with others and the risks that come with that they're not comfortable with.

[00:50:32.81] And that gives me some pause in terms of I'm not sure that all of the predictions are going to pan out. And history again would tell me they usually don't in the way that we're thinking that everything's going to pan out, that those predictions usually don't come to fruition, that there is some alternate version that ends up kind of happening. And I think Jeff's right that there probably is going to be a lot of public bailout of private shareholders with their investment in a lot of this, but I think it also demands of us more careful consideration in terms of because of the sheer scale of investment that we're talking about, because of the sheer amount of not just money, but of effort, of space, resources that are going to be needed for this, bailout alone is certainly going to be something that's going to be on the table should anything that I'm worried about pan out. But I think there's also other concerns that we haven't really dealt with because, as Jeff said, this is unprecedented growth. This is unprecedented expansion.

[00:51:40.00] And that raises concerns in terms of, is there a cost to having too much bandwidth? I use the bandwidth generically. But in talking-- is there an adverse cost to having too much infrastructure here to support all of this? In the past, that was less of a case. And I would say that there was less of a worry about that, that somebody would find a benefit to it. Somebody would use it. It would be a benefit to someone, and there'd be use.

[00:52:10.28] I don't know if that's going to be the same case with this infrastructure. I don't know if that's going to be the same. I am confident that if it is out there, if it exists, there will be some use for it. But I don't know if it's going to be the maximized economic-- I don't know if we're going to get a return on that investment, I guess, would be my concern.

[00:52:30.19] DAVID REED: Now, I don't know where Matt is, but officially lost control of the session here. And we're talking bailouts.

[00:52:37.17] [LAUGHTER]

[00:52:38.90] JASON SCHWENT: We got this, David. Don't worry.

[00:52:41.65] DAVID REED: But I mean, I'd like to hear what the other panelists have to say about bailout. I mean, some of these companies have a pretty large stash of cash, right? I mean, they're not-- Apple has got a lot, but--

[00:52:58.67] CASEY LIDE: Well, that's a distinction between what's happening now and what happened in the dotcom era, right?

[00:53:03.29] DAVID REED: Yeah.

[00:53:04.13] CASEY LIDE: I mean, those companies who speculated heavily at that time were on a prayer and a hope and a dream.

[00:53:11.45] DAVID REED: Yep.

[00:53:11.75] CASEY LIDE: These companies have vast piles of cash that they're able to put into this, a lot of it basically on spec. And so it's a little bit of a different scenario. I don't disagree that there's--

[00:53:24.42] JEFF CASEY: I wasn't rooting for a bailout, nor was I suggesting one is needed. I'm saying should the worst happen, history might paint a similar picture.

[00:53:32.40] JASON SCHWENT: Yeah, no. Yeah, absolutely.

[00:53:33.48] JEFF CASEY: Just to be clear, just to clear my good name, David.

[00:53:35.74] DAVID REED: OK.

[00:53:36.48] JEFF CASEY: Sorry. Please, Casey.

[00:53:38.51] CASEY LIDE: Well, I mean on the fiber side of things, if we can transition to that--

[00:53:43.80] DAVID REED: Yeah, go ahead.

[00:53:44.60] CASEY LIDE: --there are a lot of parallels to what happens. Again, back in the dotcom era, there was a lot of fiber put in the ground, and then a few years later, we had WorldCom blow up. And a lot of that fiber sat there unused. Meanwhile, lots of people didn't have good internet access at home. The resource was not put to its highest and best use by any stretch.

[00:54:04.56] And so let me back up a little bit, and then we'll-- so when we talk about fiber cable, we're talking about strands of glass within a cable. And it always comes in multiples of 12 strands of strands of glass within the cable. And so for a long time, you'd have a 72-strand fiber cable, maybe a 144-strand fiber cable, and that would be enough for a good metro scale network, or maybe run by a utility or something like that. And that was a lot of fiber.

[00:54:34.47] You could-- a medium-sized city, all the people around. And you felt pretty good with that. Well, over the last few years, it's changed a lot. And if you are a fiber owner or developer, and you even want to have a conversation with the hyperscalers and Meta about connecting to data centers, 864 count is table stakes to even talk to them before they'll even talk to you about it.

[00:54:58.77] So I'm working on a project out further west than here. It's a 300-mile link between two data center complexes, if you will. The plan is eight micro ducts. And in each of these eight micro ducts is an 864-count cable. So you're talking a total of 6,900 strands connecting, just connecting data centers.

[00:55:25.21] So then let's talk about mileage. So right now, there's about 95,000 route miles of fiber throughout the United States. And according to one estimate, in order for AI to scale effectively, whatever that means, we need it to be about 187,000 miles by 2029. So that's doubling the route miles throughout the country. Now, is that going to happen? No, I just really don't think that's going to happen.

[00:55:52.99] And so this gets back to our point about there are some constraints on power. I mean, is it really realistic we're going to make those investments within five years? It's just boggles the mind. I don't see how it works that way. And some of the same thing is true with the fiber investment that everybody says is necessary for AI to reach its true potential.

[00:56:12.93] And there's some other things going on here that are a downward pressure on being able to meet these aspirational goals. For one is fiber supply. So it's really hard to get high-count fiber right now. And generally, this gets back to the balkanization of the industry and the only five companies really being able to do it.

[00:56:31.18] Meta just did a $6 billion deal with Corning for Meta to get a lot of supply from Corning. If you're looking to do anything high count right now, it's really hard to do it unless you're a Meta or an Oracle or anybody else like that. And so that's one constraint.

[00:56:47.80] Another is labor. You've got very limited labor capacity out there for people who know how to work with fiber. It's just not there. And so there's a lot of programs trying to boost that, but that's a very constraining force on this.

[00:57:02.12] And underlying all of this is the vast pressure for speed of deployment. And so the big providers, if you can-- let's say you do have access to all that fiber-- and you do have access to a construction crew who can do it-- unless you can do it really fast, then your value to the Metas of world goes down a lot.

[00:57:24.37] And so then you're faced with permitting as a delay, right? And permitting can take a long time. Now there's some legislation in Congress that may make a difference on that. For better or worse, there are a lot of good arguments both ways on that, I think. And so there are a lot of things that are potential constraints on the investments that we're being told must be made in order for it to be a success.

[00:57:49.51] And at the same time, getting back to, is this really the best use of the money? there's a $42 and a 1/2 billion program called BEAD, which some of you are probably familiar with-- the Broadband Equity Access and Deployment Program that was started from the Infrastructure Act a few years ago.

[00:58:07.35] Its objective is to connect all of the unserved and underserved locations in the country with broadband of at least 100

meg by 20 meg. Laudable goal, right? Well, all of that money is about to be dispersed, basically starting now. The first few states have been approved now, so it's going to start being rolling out the rest of this year into 2027.

[00:58:29.06] Well, those guys need fiber. They need construction crews. They need permitting. How's all this going to happen? These things go right at loggerheads at each other.

[00:58:41.08] And let's say you have a route from Meta-- maybe that western route that I talked about with that vast capacity of fiber going from point A to point B. Maybe there's a little town or a little cluster of houses right off of it who are underserved. I'm not optimistic that Meta-- and I don't mean to pick on Meta. I'm just using that as shorthand for all of them if any of them are online watching.

[00:59:03.70] But I don't know that they're going to be very open to the prospect of a lateral connection from their network to go serve these unserved or underserved places. Maybe they would. And maybe this is an opportunity for them from a PR perspective, or just a good thing to do. But it seems to me they could leverage some of this investment to that other purpose as well. But we haven't seen it yet, as far as I'm aware.

[00:59:32.03] DAVID REED: But I mean, as a follow-up question for you, the data center is, in essence, somewhat taking what, in the old web services, was the application server. It's become a complex that's become a data center now if you augment it with AI. So it's been part of each application platform, whether it's Google for search or Meta for their social media.

[01:00:01.61] And so there's never really been a requirement for the interconnection of different application servers with each other. They all connect to the internet. And that's important that we have that interoperability. But it does lead to the question I think that I had raised with Gordon about-- we're really bulking up the private network side of our infrastructure. And if there isn't a very robust public network side that allows those without the scale to be able to do what they need to do to be able to grow to become the next Google, then that could be a problem.

[01:00:46.24] The other question, though, for you is that not only is there need for folks who can connect fiber, as you were talking about, between different locations and the access network or middle mile or even the backbone; you also need those folks in the data centers because you've got a lot of fiber running around in there, right?

[01:01:12.46] CASEY LIDE: That's right, yeah. The data centers themselves have a huge amount of fiber needed within it. And that's not something we or our practice have done a lot of. I mean, Gordon may have some insights on that. I don't know. But yeah, within the data

centers themselves, there's just fiber rolling around in there. And so then that gets back to the supply constraints at the same time.

[01:01:31.10] DAVID REED: Yeah. Any other comments here on what's been said before I transition? OK. All right OK. So for my next question here is for the entire panel, and then I've got a couple more, but then I'll open up the floor to questions so you can prepare your questions. Part of putting my professor hat on, I just want to break down the current conventional view of the components or of the root causes of driving demand. So I'm meeting Matt's definition here so everybody walks away with it.

[01:02:09.25] When we say the demand for data centers, I want to have basically a short discussion of what that means. And then I have a question then for the panel for their reactions to this breakdown and the future trends and the various demand components. So this wasn't a question that was provided in advance. So if you're relying on AI for your answers, you're out of luck. [LAUGHTER]

[01:02:36.43] So to begin, that's based-- and this is based, in part, of what you've said already. So we have components of this already discussed. The root sources for this demand for data centers can be grouped into several categories here. The first is the foundational model training for AI, and that's a current primary driver. That is real and ongoing. That's driving the need for new data centers.

[01:03:10.26] And it is the largest one, and it's used across many applications-- OpenAI, Meta, Google, et cetera. For those who-- just again, I just want to make sure everybody is understanding what we're talking about up here. A foundation model is a large AI model that's trained on very broad data sets and designed to support many downstream applications. And these are the Large Language Models, the LLMs.

[01:03:37.90] So training one frontier model may require tens of thousands of parallel GPUs, which are the type of processor that you use in doing this training, running for weeks or months, and which is-- this is a key reason that firms are building these AI-specific data center clusters. So it takes a long time for this.

[01:04:04.59] I said frontier model, not foundation model. So I want you to know a frontier model is an AI platform built around the most advanced models currently available. So they're pushing the limits on the computing power, data and algorithmic capability, all right? So all frontier models are foundational but not vice versa, all right?

[01:04:28.09] So the second category here is model for demand-- is model inference at scale. So after you've done your training, the models must serve what we call inference workloads. And that's responding to user queries. And so examples for this include conversational AI systems, search assistants, automated coding tools, enterprise, AI co-pilots. And these services run continuously, and they

require large fleets of these his GPUs or AI accelerators in order to operate. And so the inference workloads often consume more total compute over time than the initial training, all right?

[01:05:16.34] So you train it. And so training isn't like this big bump, and then everything goes down. Assuming you have some success, the inference can be more-- especially once you reach millions of users. And you're talking about some of the stats being able to achieve that.

[01:05:34.50] So category three here is AI integration into existing software platforms. So another major driver is integrating AI into existing products. And we see that with these AI assistants when you're on search or on a office productivity software, PowerPoint. You got your designer now and things like that. So these integrations require large-scale inference infrastructure and are another key demand.

[01:06:02.23] Forth is the enterprise AI adoption. So businesses across many sectors are beginning to deploy AI internally, whether it's finance, health, et cetera. The enterprise demand often involves training custom models on proprietary data sets and operating internal AI systems is emerging but rapidly growing source of demand.

[01:06:25.67] Then the next category are traditional cloud services, the web services that we talked about. And so these provide on-demand computing resources delivered over the internet, essentially allowing organizations to-- if need be, they can rent or build computing infrastructure if they're not operating. They can't rent if they're not operating their own data centers.

[01:06:50.17] These services typically include virtual machines, data storage, databases, networking, and application platforms which support the web loads that you need for web hosting, e-commerce, and mobile applications. So the web services scale-- and this is an important point. The web services scale by serving many small independent requests when you're using these services, while AI scales by concentrating massive computation into tightly connected clusters.

[01:07:22.01] So there's different loads that they place upon your data centers. And that concentration then drives the new design requirements for modern data centers. They can't just scale up without some different design when they're going from the web services where they've been to AI in the future, all right?

[01:07:45.73] So then the last category here are the forecasted future applications. So there's a portion of these new data center that presumably reflect expectations about future demand, the AI agents, autonomous vehicles, AI-powered software development, and traditional cloud services. These are still emerging. And really, there's a lot of uncertainty, but the infrastructure providers are building capacity ahead of that demand because AI clusters take years to deploy.

[01:08:17.98] Back in the broadband days-- and I'm maybe dating myself. But if you remember the film Field of Dreams where they built the baseball field, and then if you build it, they will come? That's what we used to say about broadband networks. If you build it, and you have 10 megabits per second, they will come. And you will say, well, of course, they will.

[01:08:43.96] But back then, we had AOL and servers, and we were downloading email, and it took 20 minutes to do that and the like. So this is a Field of Dreams approach, potentially, with some of these applications.

[01:09:01.37] So now, for those of you here this morning, not drawing upon Professor Surden's opening keynote this morning, he proposed a rule. And for those who are Silicon Flatirons community, you know there's the Phil Weiser rule and different rules.

[01:09:16.85] So the Professor Surden rule is that forecasts of five to five years can be reasonable, but more than five years are problematic at best. Doesn't have a good track record.

[01:09:29.43] So my question for the panel here is, whether these different demand components represent a reasonable set of forecasted demand over a three- to five-year time frame. So we've got the best these-- there's uncertainty here, and we've kind of captured the best we can.

[01:09:49.89] And second, what do you think will happen over the next five to 10 years? So under the Surden rule, I've got a gotcha question-- [LAUGHS] --becuse it's hard to answer that correctly. But will there be new emerging categories? Or will they drop out? What do you think is going to happen here under this view of where demand for data centers and the drivers for it? So who wants to go first? [LAUGHS]

[01:10:23.30] GORDON DOLVEN: Sounds like well-diversified approach in terms of demand So the question was the five to the five to 10?

[01:10:32.20] DAVID REED: Yeah.

[01:10:32.84] GORDON DOLVEN: Sort of thinking about it down the road. I think the main challenge is all this infrastructure-- to Jason's point-- in terms of utilizing it to its fullest capability. We don't know necessarily what those killer apps are going to be until the, is it the cart or the horse? And so to predict things that far into the future seems like a frivolous activity.

[01:10:57.09] But I think it is a sincere approach to think about adoption and utilization of technology, if it's going to slow, or if it's going to accelerate, if it's going to continue to be integrated into our lives, or if it's something we're going to walk away from.

[01:11:15.71] Jason said results are mixed at best. I think we all are grateful we don't have to print out directions at home before we get on the road and drive from Denver to Boulder to remember where this parking lot was, where we had to be today. Or maybe some of us like the convenience of watching movies in our houses as opposed to driving to the movie theater. And so, in terms of results, I think we won't know the results until three, five, 10 years down the road in terms of what we're building out today.

[01:11:43.71] I do want to just reference one point in terms of the labor component of this whole demand cycle. In Jeff's world, it's all about the construction side, the electricians, the mechanics, the engineers, the technicians, the plumbers now with site design. As the chips continue to evolve, as the hardware continues to evolve, so will the site designs and the data centers.

[01:12:07.50] It's not the norm for data centers to be built on thousands of acres from a historical perspective. It's also not an assumption to think that they will always build on 1,000 acres in terms of land use. So I think in terms of thinking about things and demand drivers and how things shifts, it all comes down to that hardware piece. And I think everyone agrees hardware will continue to evolve and to change. And as a result, so will the data center.

[01:12:32.34] So demand will continue to shift and to evolve as we go down this road in terms of adoption and evolution of these products and services. But the killer apps-- everyone points to the autonomous vehicles, the drones, the internet of things, devices. I'm not so sure that those will be the things 10 years from now we'll look back on in terms of using the most compute in our lives. I think it's the great unknown.

[01:12:58.52] JEFF CASEY: All right. Three to five years, I'll be really confident and say that chat and search are not the killer apps for AI. It seems obvious that that's the bellwether application that everybody uses. It's very approachable. Anybody can use it, but that won't be the thing that transforms our human capital or our workforce.

[01:13:17.62] Five to 10 years-- we're starting to already see this, but I see the biggest risk not of what we're talking about here and some incredible downfall, but rather this concept of crowding out. And Casey, you pointed on it, and you just picked up on it on human capital. We're 300,000 to 400,000 construction workers short in our country. We need to bring on in the next, I think, five years, another 200,000 to 300,000.

[01:13:42.78] AI alone needs 400,000 construction workforce. These are all skilled people. And this crowding out takes away from other things that we need in society. And I also think the crowding out potentially is covering up maybe some soft spots in the economy. Like, data center growth is covered up 50 to 75 basis points a quarter of

maybe what's actually going on in the economy and maybe is distracting us from things that we should be looking at.

[01:14:09.89] And so my five- to 10-year prediction is the crowding out effect will start to reveal itself at some of the underlying things that we were looking at weren't as good as they thought. And we distracted ourselves from things that we actually need in the name of things like national security in exchange for doing the things we should have been doing. So that'd be my five to 10. A little soft, but I think crowding out will reveal that we've done the wrong thing.

[01:14:36.97] JASON SCHWENT: I think that's an excellent point. I think the three- to five-year prediction with respect to this, I do think some of those limitations that you noted with respect to not on necessarily the technology side, but didn't yet just human capital in order to make some of this stuff work, it's not there. And I think you're going to see some of the strain on this supply as those limitations are kind of exposed. And then, it's a matter of, is the market going to pivot to new technology or new ways of handling this?

[01:15:17.38] Will chip design solve some of those problems? That that's a little unknown. And that's where we're talking about, that five to 10 and beyond. I also think, quite frankly, developments in quantum computing may drastically shift.

[01:15:31.08] JEFF CASEY: I was going to say nuclear quantum in the 10-year window.

[01:15:35.72] JASON SCHWENT: That combined with some of the capabilities of AI-- if the multiple facets that quantum computing can address, compared with the vast amount of data that AI can address, that combination could really shift a lot of what we're talking about in this marketplace. And either depending on how-- because, again, the infrastructure with respect to quantum computing is out of this world in terms of what we're talking about. But that, I think, you could see some major really developments there.

[01:16:11.47] At the same time, I think it's equally likely that the limitations you're talking about could lead to a real regression with respect to a lot of this technology, that it's just not possible. And that the models that they needed, the scale that they needed in order to make this profitable won't develop. And then where do you regress back to? What is it going to fall back to? And where are you going to see, technology at that point? And I think longer scale, I think those are equally possible. And it's unclear exactly where that will play out.

[01:16:44.44] CASEY LIDE: Three to five-- this is a hard question, David.

[01:16:47.56] [LAUGHTER]

[01:16:48.50]

[01:16:51.54] I wrote down some comments. And I'm realizing, gosh, I'm really skeptical.

[01:16:55.52] [LAUGHTER]

[01:16:56.70] And I don't know if that's a good thing or not. But I feel like what's going on right now is in some respects a land grab, and it's pretty speculative. One thing that concerns me in the next three to five years is, is the subscription revenue model going to pan out in a meaningful way? Or are they just trying to get us hooked on it now for free and then start monetizing it? And is it going to be useful enough for people to keep paying more and more to justify the investment? I don't know. And I think we're going to have some clarity on that in the next three to five years for good or ill.

[01:17:28.64] I think there's overprovisioning going on because there's a risk of fear of missing out. There's a risk of missing out. And nobody wants to be last one standing while their competitors have gone ahead to whatever. And so at the same time, they have huge cash reserves. And so there might be a little bit of a war of attrition going on.

[01:17:51.57] I think there could be a pullback from the lofty predictions of investment and what's actually really needed to make things happen. There could be a scaling back of expectations in the next three to five years. Five to 10, who knows? I think quantum is a really interesting wild card to it all.

[01:18:10.25] And things like nuclear-- and then farther down the road, it's always 30 years out. But fusion, things that could really upend things. And I think that may be the place that a lot of these companies are looking to. They want to be there when that happens because that's where, I don't know, endless profits or something is waiting for them, I guess.

[01:18:32.59] JEFF CASEY: Cryptography out the window at a minimum, right?

[01:18:34.95] JASON SCHWENT: Yeah.

[01:18:35.15] DAVID REED: So as a quick follow-up question for the rest of the panel, since you anticipate a little bit. Are we going to see an ad-based model used an order to recover some of these costs?

[01:18:49.63] JASON SCHWENT: It's been the method. And history says yeah, that that's where they'll be.

[01:18:54.97] CASEY LIDE: Highly targeted.

[01:18:56.07] JASON SCHWENT: Yeah.

[01:18:57.03] DAVID REED: Well, and what I didn't hear really-- but, potentially you hear sometimes running around the broadband conferences is how AI is going to transform and fill up the local access

pipe with traffic because each one of us are going to have personal assistants that relies on AI that's going to be multimedia.

[01:19:20.07] It's not just little messages that we get now or interactions that's data, which is low bandwidth, but it's pictures or you're storing what your glasses recovered, or you're constantly are recording. You remember, what, 10, 15 years ago, there was a person who was recording every second of their life for a while, if you remember. And that was a big story.

[01:19:44.92] And with this technology, you potentially could fill the pipe with a lot of personal information that at least when-- I don't have a Facebook account, but a lot of people put a lot of pictures of what they do all the time on social media. And this could basically amplify that quite a bit, right?

[01:20:04.64] JEFF CASEY: I mean, if you don't pay for the product, you are the product, right?

[01:20:07.24] DAVID REED: Yeah.

[01:20:07.76] JEFF CASEY: So your data in this case is the product if you're not paying for it.

[01:20:10.64] CASEY LIDE: But most of it's low bandwidth going upstream so far, it seems to me. I mean, the internet of things, remember that? Where's that, by the way? That's basically low bandwidth streams from devices going up. And I think that a lot of that may play out kind of the same way. And we're not all sitting here wearing Google Glass. There's some human nature going on here that I think the tech companies like to overlook.

[01:20:37.26] DAVID REED: But I am wearing a watch that--

[01:20:39.95] [LAUGHTER]

[01:20:40.88] MADDI CASTELLANO: I got to step in here because I got questions in the audience here. This is an amazing panel, and so we're going to take a little bit more time. You still get your break. In keeping with the Phil Weiser rule, do we have a question from a student? And our mic runners will come out to you.

[01:20:55.15] Otherwise, the first question I-- do have a student here. Yep, Dalton.

[01:21:00.69] DALTON: Well, Jeff, I want you to know I bought some stock on your assurance that I'll be bailed out.

[01:21:06.01] [LAUGHTER]

[01:21:09.83] Aside from that, I think one of my thoughts-- and we talked around this bubble idea the whole time. But I want to advocate really quickly-- and maybe this isn't my whole view, but I want to advocate for bubbles in the sense that it's driving a lot of investment in

something that I think what Gordon talked about is the great unknown. And even if the timeline is really far off, we have put a lot of investment in this infrastructure that could possibly be used for other things.

[01:21:42.70] And then secondary to that, we're driving up cost, which also brings innovation because now we're saying, hey, it's a lot of energy to do this. These chips have gotten pretty expensive. Everyone's competing for the same chips. How do we drive down these costs, which I think will also lead to innovation? And so what are some thoughts on advocating that maybe bubbles in some sense are good. Like, the broadband bubble brought a lot of infrastructure as well. So could you talk about that?

[01:22:13.88] CASEY LIDE: I think there's a valid point there. The broadband bubble is a good example. And dotcom bubble, it was a short-term lots of pain, but long-term lots of good, I think. And so that also kind of plays into the truism of technological advancement being overestimated in its short-ter, impact and underestimated in its long-term impact. And so I think some of that holds true.

[01:22:38.07] JEFF CASEY: I would add that there is nothing like the-- I'll call it the venture world, or the investment world or the risk taking world of the United States. It's one of the characteristics that we have that other countries, even Western countries in Europe, don't have and they think we're crazy. And then you show up, and we're leading the world in a technology.

[01:22:59.77] And we take more risks, and we chase more fun things, and we put more at-risk money at things that may or may not work out than any other country. And I think you're right. We should celebrate a lot of this investment because the outcomes are ones we don't know today.

[01:23:14.45] MADDI CASTELLANO: All right. I see another question up here. And I'm taking the MC's prerogative this afternoon. So we're going to go a little bit late, but your break is coming, folks. It's just a great discussion.

[01:23:24.25] DAVID REED: That was my fault. I was off the old schedule. I'll take that.

[01:23:27.53] AUDIENCE: So thank you all for really providing a lot more depth to this what I've been reading in the news articles I want to play another scenario here in regards to creative constraint theory. And so we talk about-- you've convinced me, the likelihood of us being able to meet the demand with supply and the timeline is pretty low. But if we use the theory of creative constraint, what ideas come to mind in regards to what we could do in that context?

[01:24:06.47] DAVID REED: Any takers?

[01:24:07.92] GORDON DOLVEN: I want to lean on, Jeff, in terms of optimizing the grid and utilizing the grid to its fullest capacity. I mean,

the challenge with the grid is that in the '60s, '70s, and '80s, we actually had an overbuild of generation in the country. And then we had all the manufacturing go overseas and load really stalled. And so these we're asking these utilities to act very swiftly and very fast to bring on more generation and, more importantly, to bring on more transmission. And so I think the optimization and the efficiency gains in terms of the electrons, I truly hope that is what's something we can optimize.

[01:24:44.52] MADDI CASTELLANO: All right. We're going to take five more minutes if we can. I see a question right here.

[01:24:51.39] AUDIENCE: Yes. I'm assuming the demand is going to be there. And I think energy will become the long pole in the tent. And part of what we've experienced-- I wrote a paper on the smart grid 10 years ago, and nothing has happened since then. And 10 years ago, they said Edison would have been intimately familiar with the grid, and he still would be.

[01:25:21.24] So do you think the fact that we need a new model-- because we're in a highly regulated environment where utilities-- they are constrained in how they can make investments? And there's things like microgrids. I mean, Google built a data center that used fuel cells 10 years ago. And you have control problems because energy, renewable energy is intermittent. Will this, do you think, stimulate a new kind of model, like, a new kind of company will come that'll be a combination of locally generated of the microgrids? Because it's not all generation and transmission. There's a ton of things to the smart grid. And again nothing happened.

[01:26:18.27] MADDI CASTELLANO: Jeff, I'm looking at you.

[01:26:19.61] JEFF CASEY: Yeah. Where to start? It is hard to replicate the grid behind the meter. I'll start there. Like a lot of people say, it's easy. We'll add grid resources behind the meter, and we'll make it as reliable as the grid. We take for granted the incredible engineering and thoughtfulness that has gone into creating the world's largest machine to be as reliable and as resilient as it is. So there are trade-off decisions with every engineering decision, especially around microgrids and behind-the-meter generation that need to be considered.

[01:26:48.56] Yes, it's been done. You need something that has a higher capacity factor, like small modular nuclear reactors, to sit behind the grid, to be able to island that seamlessly. That was number one.

[01:26:58.96] Number two, it's the old adage. We have three choices. When we do something, we can do nothing. We all probably agree that's not right. We can build it bigger. That's what we're talking, about doubling the amount of fiber, doubling the amount of generation, maybe doubling the size of our grid. We're talking about $70 billion of

765 kV. Right now, the United States has very little of it, and we're talking about adding that. Or you can use it smarter.

[01:27:19.92] And I think the promise of the SMART grid has not been realized. I think components of the SMART grid have been implemented, but the total vision of this integrated system where we use our resources more intelligently has only come in small pockets on use case by use case applications. It's never been holistically transformed the way that the grid is used.

[01:27:40.65] When we talk to utilities about how they interface with hyperscalers, we say, number one, leverage their balance sheet. You shouldn't be taking some of the risks you're being asked to take. Number two, you need to be considering different commercial arrangements or models in the way that you work with them. Maybe it is part of an unregulated business, and we've seen that with Exelon spinning off constellation and some of the things that they've been talking about publicly, I think that could be really exciting.

[01:28:08.61] And the third part of your question was around, can we use the technology of AI to solve grid problems? And I think you mentioned that. I don't know. I think the answer is yes, but how and when, I don't know. But part of using it smarter, we should take the technology that they're building and apply it to problems that we have. But the engineer in me, and probably David at the end there, would say physics always rules. And we're not going to invent a new type of physics as we go down this journey.

[01:28:37.70] JASON SCHWENT: Yeah, I mean, I think some of the constraints that we're looking at with respect to the infrastructure build that have been noted-- Jeff and Gordon both have talked about the fact that maximizing what we have now is certainly a priority. And everybody is working towards maximizing every little bit that does exist now. And I think that will hit a limit, and then you'll have to see some innovation in that space in order to increase what is there, given the limitations with respect to construction, given limitations with respect to fiber and other just physical constraints that are there.

[01:29:12.46] They're going to have to come up with a different approach. And that's where, yeah, the technology of AI that's been promised promise. That's one of the things that's supposed to be able to help analyze those large chunks of data to help come up with better solutions. Couple that with potentially the use of quantum computing, which can take that to another level, quite frankly. Then you could potentially come up with new potential solutions to that. And I think it is going to be--

[01:29:38.99] JEFF CASEY: We're not talking like a marginal increase of area under the curve that we're going to optimize for this small time of one day. We've talked about the inverted duck curve in California. And if we do some load shifting and smoothing, we can solve these

problems. I mean, yesterday we heard-- I think it was 1.2 system, and they have two gigawatts of connection requests, which means they're going to have to build a forced gigawatt system. There's nothing smarter to do there unless we optimize something that we haven't figured out yet.

[01:30:05.77] MADDI CASTELLANO: Yeah. Thanks, guys. One last question. I see a hand up right in the back there standing.

[01:30:09.93] AUDIENCE: I'll be quick. Thank you very much. This has been so entertaining. It's taking me back. Let's see, 30 years ago, I think, on February 8, what did we have? We had the Telecom Act. And you guys were talking all about the big four powers coming?

[01:30:24.27] And the Telecom Act created the CLECs. And I think what's going to happen when we don't service Easter Island and those local exchange characters? Is the federal government going to come in? And do we have a possibility of another Data Exchange Act? So maybe we have Clay Dex for competition. Are we going to have to break up these big mega data center owners that are privatized?

[01:30:50.83] JASON SCHWENT: Or are you going to see a stratification of the market? Are you going to see that there's supply and there's infrastructure for certain players? And others, they just don't get anything? That those who are looking for connectivity in a smaller town or in a smaller area that it's just not economically feasible so they don't get it? And is that the result that's going to be forged out of this?

[01:31:16.40] CASEY LIDE: I mean, look what look what happened with the Telecom Act. You had the notion of breaking up Ma Bell, and it's going to land a full of CLECs. And then they all consolidated, right?

[01:31:27.06] And so, I mean, even if you can make the leap of the federal government politically having the wherewithal to break up the likes of these companies, which is unfathomable, who knows? 10 years, whatever. But it could happen. I mean they'd have to strengthen the Sherman Act a lot, I think.

[01:31:48.78] CASEY LIDE: I mean, California's larger economy than the UK, and we're not going to kneecap ourselves in the world economy to break apart a company that we don't like what they're doing. History again probably says we wouldn't break apart a big company like that.

[01:32:04.00] JASON SCHWENT: Yeah, I would think so.

[01:32:05.12] MATT SCHMIT: Well guys, this has been a great conversation. We're going to take about a 15-minute break here. But before we do so, give our panel and moderator round of applause.

[01:32:12.64] [APPLAUSE]

Panel 4: The Supply Side of Big Data

https://youtu.be/YuLCO8V13jQ

[00:00:00.16] MAX PATTEN: All right. Thanks for your patience and I hope you enjoyed the snacks and everything. Now, after covering the demand side in the afternoon, there is a supply side of big data. Crucially, data centers need lots of water, lots of land resources, lots of energy resources. That's why we're very excited to introduce panelists who come from those perspectives.

[00:00:18.84] So moderating, we have Chris Winter here at CU at the Getches-Wilkinson Center for Natural Resources, Energy and the Environment. Marshall Brown, General Manager for Aurora Water. Jack Ihle, our VP of Regulatory Policy at Xcel. Stacy Tellinghuisen, Deputy Director of Policy and Clean Energy at Western Resource Advocates. And Rebecca White, Director of the Colorado Public Utilities Commission. Thanks.

[00:00:43.70] CHRIS WINTER: OK. Thanks so much. Again, my name is Chris Winter. I'm the executive director of the Wilkinson center here at Colorado Law School. And GWC is a research institute, much like Silicon Flatirons, that focuses on the sustainable management of natural resources across the American West, including issues relating to water, energy, public lands, and the intersection of those issues with climate change and the rights of tribes and indigenous peoples.

[00:01:09.21] So I'd like to start by thanking Matt and Silicon Flatirons for the opportunity to help facilitate this conversation today, because I think that the build out of AI infrastructure and data centers cuts across so many issues that are critical to the future of our communities here in Colorado and across the West. So I'm really happy to be here. We also know that there's a lot of snow falling outside, so thank you for making the effort to join us.

[00:01:33.57] Thank you to our speakers for trudging through the snow to join us today. Some of us might groan at the thought of traffic delays and shoveling off our sidewalks when it snows, but of course, many of us here in Colorado also breathe a sigh of relief to see snow falling from the sky. And that's because this has been one of the warmest and driest winters on record here in Colorado.

[00:01:54.83] And we rely on snow here in Colorado, for clean water to mitigate fire risk, to support our agricultural and recreation based economies across the state. And climate change is really threatening the fabric of our way of life, here in Colorado. And so this is a good reminder, really, of why we're here and why so many people care about the conversation we're going to have today. Because Colorado,

like many places across the West, has invested decades of work and hundreds of millions of dollars into sustainability initiatives.

[00:02:23.82] This includes decarbonation of the energy sector. We have binding greenhouse gas reduction targets, here in Colorado. We're supposed to be working towards a net zero economy by 2050. We have invested hundreds of millions of dollars into water conservation measures, and the Colorado water plan is, of course, being worked on hard, across the state. Smart community planning and many other important long term efforts.

[00:02:48.82] And those initiatives enjoy broad public support here in the state because people feel the effects of climate change every day, here in Colorado, and we're worried about the future. And so that's why I think people are truly hungry for this conversation, for accurate, meaningful information as to what the development of data centers truly means for our communities and environment and our economic prosperity here in Colorado. And so I think we are all looking for real world solutions.

[00:03:14.87] I hope we can talk about those today. Data and information. And we know that this demand from data centers for our resources is likely here to stay. So we're thrilled to be able to host this panel because these are the experts, I hope, who can help provide us with a deeper understanding of both the challenges we face and how we can get this right for the people of Colorado and people across the West.

[00:03:39.65] So I'm going to start by asking each of our panelists a question, and I'm going to ask you all also to introduce yourselves and provide a little bit more background on how you come to this issue and the position with the organizations that you represent. So I have some opening questions and then we'll do some further panel conversation.

[00:03:59.34] And I hope to leave some time at the end for some questions. I know I could tell from the last panel, there's really a burning interest from the audience, from all of you to ask some questions of our panelists. So I hope we'll have some time for that. And Matt has been kind enough to give me license to run over. So we may bump up against 4:30. So I'll try not to cut into too much time. For the reception, but I think this is a really unique opportunity for this conversation.

[00:04:23.14] So why don't we kick it off. I'm going to start with Jack. And Jack panel 1 today, highlighted the dramatic increase in demand for data center expansion and energy consumption. And so I'm hoping you can share with us some information on how Xcel is approaching the work to meet this need, both in the immediate sense and also sustaining that into the future.

[00:04:47.60] JACK IHLE: All right. So I think we start with our introductions and then I can answer your question in a bit. OK. Jack Ihle. So now my title is out of date on LinkedIn, but I've been in the data center role. I'm a VP of data centers in large loads for Xcel Energy, which is across all of our eight states of service. And I'm just about hitting the 100 day point, the proverbial 100 day of my administration in that area.

[00:05:14.40] I was previously a Regional Vice President of Regulatory Policy, so working a lot with the Public Utilities Commission, with Rebecca and the commissioners and the many stakeholders there, including Stacey as well. So my job now is to facilitate our commercial ability to serve data centers, ensure that our company strategy aligns up with that, guide our policies-- and that's across all eight states now. So that means regulatory policies, statutes, statutory policies, legislative policies, which are very strong interests across many of the PUC's and public service commissions, as well as the legislature's.

[00:05:51.87] And ensure that our communications points, strategic communications, just a pretty broad gamut of things, but related to a more narrow set of this fundamental change in our service. And you asked a super broad question, but for us, this is a huge new change in the challenge of providing utility service and energy service, where previously, we had seen load growth, that was about 1/2% per year. I just saw some EIA data that showed in 2025.

[00:06:25.25] So this is nationally the load growth or the energy sales-- I should say to be more specific-- the megawatt hour sales. I think it was about 2.8% nationally. And that's the highest number I can recall in my 25 year history in the power sector. So we're seeing that. We're seeing it in big chunks. Come along, these are customers who may be 100 megawatts, 200 megawatts, 500 megawatts, They're literally on the scale of power plants. That is fundamentally new.

[00:06:50.78] We have a few of those customers historically, but that has been probably every few decades. And now I get requests every few days. Not all of them may come through, but it's fundamentally changing our industry. But we are seeking across all of our eight states to make this consistent with Xcel Energy's clean energy policies and progress.

[00:07:12.46] Here in Colorado, we're about 46% clean energy on an annual megawatt hour annual energy basis-- that's in 2025 data-- we have reduced our carbon emissions 60% since 2005, as of 2025 data. And we don't want to stop that. We recognize that this is kind of a new challenge. We were doing that in an era where as I said, that the sales growth wasn't nearly as dynamic as it is now. And so it puts more pressure on some of the generation choices and some of the investment choices.

[00:07:44.54] But we're still seeking to do that in advance-- the clean energy, in different ways. We're also very strongly seeking to protect customers. We can certainly talk about that, but currently, I moved from supervising one large load tariff filing to now supervising five.

[00:07:59.65] In Minnesota, Wisconsin, Colorado, New Mexico, and Texas. Very, very vibrant issue. And what that means is it's the rates that are set for very large customers, inclusive of data centers. It's not all just data centers either. There are other large customers as well.

[00:08:14.41] And allocating those costs in a way that's fair, such that there is not an affordability impact to other residential customers especially, but also other types of businesses. And we are stating that our aim is to protect them fully from that and if not, provide some benefits, either monetarily or through other types of investments that this industry may bring. So maybe I'll pause there. I think we're going to dive into a lot of this.

[00:08:38.37] CHRIS WINTER: Great. Thanks, Jack. We'll definitely have some follow up questions for you. Stacy, we're going to turn to you next. And I was hoping that you could talk about your perspectives and WRAs perspectives on the demand side-- the supply side, and your thoughts on the immediate long term resource impacts, in terms of energy and especially water as well.

[00:08:59.98] STACY TELLINGHUISEN: Yeah, thanks. And thanks for the opportunity to be here and to speak. My name is Stacy Tellinghuisen. I'm Deputy director of Policy Development at Western Resource Advocates. We're a nonprofit conservation organization. We work on healthy rivers, on western lands, and on advancing clean energy and climate policies. Our work is both at the Public Utilities Commission across the region. And then also, we engage in state legislative efforts as well.

[00:09:27.28] And I'll comment both on Colorado, but also maybe provide some comments on the broader trends that we're seeing in the West. Last summer, Western Resource Advocates published a report on data centers, and we wanted to see, what is the load growth that's forecast just for the largest utilities in the interior West? And how does this compare to some of the National reports that we've seen?

[00:09:51.19] And we found-- our analysis was pretty staggering. And we are seeing the largest utilities. We're forecasting load growth of roughly 30% by 2030 and over 50% by 2035. And that's really true for almost every major utility in the West. So there's no exception to that right now. And I think our broad concern is that that level of load growth really threatens meeting our climate goals for the region.

[00:10:23.75] And I think what we're seeing is that how these load forecasts actually translate into impacts on climate goals varies by state. So in Colorado, as you mentioned, we have pretty robust climate regulations and statutes. And I think those are so far, I think, helping to

contain the impact on forecasting missions in this state. But I think we feel a lot of pressure on those regulations and on that legislation today. In other states, I think the story is more bleak, perhaps.

[00:11:01.04] So in Nevada NV energy, which is the largest utility that serves that state, forecast tremendous load growth. They forecast roughly 50% increase in load growth, I think, by 2030, and a real backsliding on their emissions goals or emissions trajectory so that they were projecting to emit, I think, an additional 30 million tons of greenhouse gas emissions in 2030 relative to their prior forecast, and that is largely because their dispatching their gas plants at higher levels.

[00:11:33.44] And so I think that's one of the biggest concerns we have is, again, how this affects our emissions trajectory. This also translates, of course, into water demands. There's water demands at the site of the data center. There's also water demands at the power plant that's providing the energy, depending on the type of power that is supporting that data center. And then the consumer impacts.

[00:11:54.75] And so from a policy perspective, where this takes us is, how do we enact policies that safeguard our clean energy and our climate goals, that protect water resources and that protect customers? And how do we leverage the vast financial resources of these corporations to help advance our goals, particularly on clean energy? Thanks.

[00:12:15.41] CHRIS WINTER: Great. Thank you, Stacy. And we'll come back to that conversation around policies and solutions in a minute. Marshall, thank you for joining us. And it's so great to have you here. And I was mentioning to you earlier I heard you speak at the Colorado Water Congress earlier this year, just a couple of weeks ago, and found that conversation so compelling in terms of the way the city of Aurora has handled the challenges, and especially some of the water challenges presented by data centers.

[00:12:39.30] And so I was hoping you could share with us. Tell us a little bit about the story of the city of Aurora, which is home to a number of data centers, including, I think, Colorado, soon to be largest data center. And, what can you share with us about the real and perceived trade offs at the local level, and how is the city approach these challenges?

[00:12:58.13] MARSHALL BROWN: Yeah. Thank you, Chris. So, Aurora, one thing that is commonly talked about with data centers are the resource requirements. And they were mentioned early, the land, the power. One thing that doesn't get talked about quite as much, but is also a requirement for data centers is fiber optics or communications in and out of the data center is really important also. And then water.

[00:13:28.64] So when data centers approach a municipality, for example like Aurora, to develop within Aurora. They've typically

already sorted through at least the energy and the communications, the fiber optics challenges before they approach us. And then they'll talk to a local entity about financial incentives or land availability or land use policies, things like that, zoning. And water tends to be one of the last things that they talk about.

[00:14:04.91] But a few years ago, Aurora recognized that there was the potential for a large volumetric need for water associated with data centers, not just data centers though, other large water users. So data centers, you probably all are aware, consume water due to the cooling demands. It's an evaporative cooling system. It's not unlike other industrial facilities cooling systems.

[00:14:32.13] So we created criteria area number of years ago. We call it our large water user guide. And we said, here's what we will allow from a water use perspective in Aurora. And it's been fascinating. The results have been a little bit fascinating for Aurora. We've received no pushback from the developers of the data centers, which is a positive.

[00:14:55.35] Aurora has eight data centers, our largest data center, which is soon to be 177 megawatt facility, uses the least amount of water because it's the newest and it came in under that criteria, and they have a closed refrigerant based system. So they consume no water for their cooling. They charge the system initially and it stays in there for a long time, just to put a comparison out there. A single family residential home uses about 5,000 gallons a month for their water demand.

[00:15:32.91] That facility now, it's not fully operational right now, and I should clarify, 5,000 to 10,000, roughly, for a typical single family residential home in Aurora, depending on if it's winter or summer. That facility, they have other indoor things going on but that data center, which is probably operating somewhere between 60 and 90 megawatts is my understanding right now. It's not fully built out-- is using 22,000 gallons a month of water.

[00:16:06.60] So only about four times two to four times-- yeah, two to four times what a single family residential home would use. So it's not a local water resource impact. Our smallest data center, which is also one of our oldest uses about 1.8 million gallons of water a month. They have an evaporative cooling system. So it's dramatic, the difference on a local water resource impact that a data center can have based on the cooling technology that they incorporate.

[00:16:40.67] So we chose to create criteria and say, here's what will support in Aurora. And the data centers have stepped up and are creating very little local footprint on our water resource on the demands that they put on our water resources.

[00:17:01.85] CHRIS WINTER: Thanks, Marshall. That's fascinating. Rebecca, thank you for joining us. Really looking forward to hearing from you as well. And this issue isn't going away anytime soon. And so

I think we're interested to hear more about how Colorado PUC is preparing to continue to have this conversation, balancing different perspectives and concerns related to this issue regarding data center expansion. And so I'm hoping you can share some comments with us on where you see this conversation headed at the state level, and how the PUC is thinking about this moving forward.

[00:17:33.30] REBECCA WHITE: Yeah, sure. Well, good afternoon, everyone. So in the spirit of the introduction, my name is Rebecca White again. I serve as the Director of the Public Utilities Commission. I've been there about three years and have learned in that time that the PUC is not a household name to virtually anyone. Maybe this room accepted. But we are the primary regulatory body over our investor owned utilities in Colorado.

[00:17:57.06] And so for purposes of this discussion and our electric grid, that's Xcel Energy, and my friend Jack Ihle at the end there, as well as Black Hills. So those are the two main utilities we oversee. I'll share the mission with the-- of the PUC with you, because I think it's really important to the context of this debate.

[00:18:17.74] So our job is to ensure the safety, reliability, and affordability of the utility system consistent with the environmental, social, and economic objectives of our state. That is a heck of a balance. And we are seeing all of that play out right now with data centers. So to answer your question about where we are as a state, I'll just offer a little bit of context because this is a really fascinating moment for utilities and energy policy in Colorado and nationwide.

[00:18:51.59] But right now, we're at a place where-- I would say, and I'm curious if the panel would agree with me-- data centers are still nascent in Colorado. From the latest I've seen, there are anywhere from 50 to 60 of them total. That seems like a big number, but when we look at states like Virginia, like Georgia, New York, New Jersey, massive number of data centers.

[00:19:17.63] The other thing that makes us a little bit nascent is we don't have the large hyperscalers in Colorado yet. So there's actually an opportunity because this is nascent for us to think about this in Colorado and try to get this right because we have time to prepare.

[00:19:33.66] Part of what is holding data centers back, I think, from coming to Colorado, which is another interesting context, is we don't offer sales and use tax exemption for data centers. And that has been a big driver for them coming into other states. We don't have that right now in Colorado. The other thing that makes this so interesting at this sort of moment in time, is there's a lot of other demands on our energy grid.

[00:19:58.06] Now, data centers, by far, they're the biggest, scariest megawatt demand number. But because we're trying to reach greenhouse gas goals in Colorado, we're seeing electric demand grow

regardless. So we're trying to get people into EVs. We want to see a million EVs on the road by 2030. That's a lot of electricity to power all those cars. We're trying to electrify our homes and businesses. We're electrifying our oil and gas fields.

[00:20:23.50] So I think Jack was saying earlier that we've had-- for the Colorado PUC for the last decades, very stable, modest growth in electric demand that was very easy to predict. We could all wrap our arms around that and move very deliberately towards our clean energy goals. And now those demands are going like that.

[00:20:44.63] And so these questions of how do we stay on target to meet our greenhouse gas goals, and how do we keep rates affordable, is really important and is part of what the PUC is wrangling with right now. So to your question about what specifically is going on. So at the state legislature, there's two bills that have been introduced. They are on polar opposites of this debate right now.

[00:21:07.33] One is a Bill that's more of in favor of or drafted by a lot of the environmental groups who are very worried about data centers. And it would set a whole bunch of restrictions on data centers when they come into Colorado, including that they have to provide pretty much every megawatt would be a clean energy source. So that's one Bill.

[00:21:28.52] The other one is much more friendly and welcoming to data centers that would provide that tax exemption. And yes, it would require some progress towards clean energy, but a much different type of Bill. And so we're calling this within our halls at work, the data center wars, because there are these two very different debates. And last year in the legislature, we saw the same dynamics, and the Bill ultimately wasn't passed.

[00:21:55.68] So that part of the big policy context is what the legislature will decide to do. And a lot of that does drive on whether we're going to offer a tax exemption. But then I'll just speak to what the PUC-- what is before the PUC now. And there's a couple pieces. So Jack spoke to the fact that we expect Xcel to come in about a month with a large load tariff, which will essentially be Xcel's proposal to the Commission on how much the data centers should pay.

[00:22:22.95] So that'll be a very interesting, litigated proceeding for our three commissioners. Those are the ones who make these policy decisions to determine how we can hold ratepayers harmless, how we can make sure that these data centers are paying their fair share, which means are they fully covering their costs? And how do we guarantee that over the long term. Because the resources we need to invest in are here 20, 30 years.

[00:22:52.17] You think of a solar field or a wind farm or storage or natural gas, and if a data center is only here for 5 to 10 years, you've left ratepayers paying for that asset after they're gone. So we will be

litigating that when it comes in April. But the decision that's behind us now that I can speak to is called the just transition solicitation. And this is part of electric resource planning.

[00:23:19.61] So all the utilities in Colorado, they come into the PUC about every four years. They look out at about a five year window and say, all right, here's what we expect to need for energy demand. And the PUC, we're going to ask you to approve X number of megawatts of resources to meet that demand.

[00:23:38.35] These have always been difficult proceedings, but it was a much different context. And Jack can speak to this more than I can because I've only been there about three years. But when demand was relatively flat and stable, that was a much different set of decisions than what is before the Commission now, when we look at these huge growth in energy demand.

[00:24:00.19] So where the commission landed on this just transition solicitation, and it was called that because we're retiring our coal plants in Colorado. And part of the debate over this is making the communities whole that are losing the coal plants like Pueblo and Craig. So that was why it was called this.

[00:24:16.59] But the commission ultimately approved about 6,000 additional megawatts, but they really heavily debated any growth beyond that, because a lot of that was what you assume about data centers. And the commission ultimately said we will allow for growth to meet data centers, but we want to see a contract signed. We don't want a promise or an indication that they're coming to enable the utility to go build that resource.

[00:24:43.90] We want to see something carved in stone. So we have that decision behind us. We have the tariff coming up and then the data center wars at the legislature. And I think I talked way too long.

[00:24:58.12] CHRIS WINTER: That was perfect. Thank you. No, that was great. I mean, I think we're now getting to the nuts and bolts of actual policy solutions. And so that's exactly the kind of conversation we want to have. So, thank you for that. And I want to follow up on the point that you just made, which is the two pending or competing proposals right now in the General Assembly.

[00:25:14.02] For all of you out there, if you're following along Senate Bill 102 is the one that does not rely on Senate, and House Bill 1030 is the incentive based proposal. And those are both, as we mentioned, pending in the General Assembly, in the State Capitol. And so I would like to ask our panelists if they have views on those competing proposals, if you can share any details about those with the audience. And I think I might start with Stacy, because I know that she's done an impressive amount of work and WRA is also heavily invested in one of these bills. And so I'll turn it over to Stacy first.

[00:25:49.09] STACY TELLINGHUISEN: Thanks. So WRA has been really deeply engaged in helping to develop and shape and negotiate provisions around Senate Bill 102, which is sponsored by Senator Cathy Kipp, and representative Brown. And we think that it really sets a gold standard and creates a model for other states to pursue that creates a lot of protection.

[00:26:13.79] So it creates important consumer protections. It requires data centers to make certain contract commitments or payments that protect consumers against the risk that the data center doesn't show up or shows up at a smaller level than they initially forecast. It contains some requirements around water.

[00:26:36.38] So I think one of the big challenges that I think Marshall alluded to, is that there's a lot of uncertainty about the water use of data centers. And we frankly, don't have a lot of information on that. And what the water use looks like for different types of data centers. And so it requires some reporting and transparency and additional information. I think it will likely also set a water use efficiency standard as a baseline threshold for data centers.

[00:27:04.28] And then it requires some transparency and provisions for communities that could be impacted. I think the goal is to protect existing communities that are already disproportionately impacted by sources of pollution from another potential source of pollution. A lot of these data centers come with backup diesel generators, because they want to make sure that they have power around the clock, including in an emergency.

[00:27:28.39] And so there are provisions, for example, to limit the amount that those diesel generators can be operated during the year. And then finally, the piece that I think we're most engaged on is the clean energy provisions. And there are provisions in it that require no backsliding against utilities existing emissions goals.

[00:27:49.21] And there are provisions that require a new data center to bring clean energy to meet its load. And I think one factor or one feature of those that's important to recognize is that it doesn't just require a data center to bring a lot of new solar to the table. Or a lot of new wind to the table, it requires that data center to bring resources that can actually meet its load throughout the year and throughout the day.

[00:28:12.58] So data centers have a really high-- they're high load factor customers, so they require energy around the clock, which doesn't match well with intermittent wind or solar. And on a system like Xcel's in particular, that has high levels of renewables and is going to be getting to really high levels of renewables, one thing we are concerned about is just seeing more renewables that are brought onto the system that curtail existing renewables. Because that imposes costs

on customers and doesn't help us advance our clean energy goals in the way we want to see them.

[00:28:45.90] So that's kind of an overview of the Senate Bill 102. I think we'll likely see some modifications as we go through the legislative process and some negotiations. I'll just contrast that with Senate Bill 1030, which is the industry backed bill, which provides tax incentives. And I think it probably has some real hurdles in front of it, too, given the budget constraints in Colorado.

[00:29:09.67] I think the initial fiscal note suggested that providing these tax breaks to companies would require forgoing some tax breaks to low income families in Colorado. And I think that would be a bitter pill for a lot of legislators and families to swallow. So I'll leave it there and welcome other perspectives.

[00:29:29.83] CHRIS WINTER: Great. Thank you, Stacey. Jack, I'm curious to hear from you. If you or Xcel have thoughts or feedback on these competing legislative proposals. And I'm also especially curious about your reaction to the renewable energy requirements in Senate Bill 102. And whether you think that's doable and how you've reacted to both of these legislative concepts.

[00:29:52.01] JACK IHLE: Yeah, thank you. We've engaged on both and we're following both. And Rebecca's right that the similar concepts were afoot in the last session and did not pass. I think there's work to do on both. I would say we have a little bit more concerns with some of the clean energy policies in 102, just from sheer practicality.

[00:30:12.40] The concept of meeting every single hour with renewable energy is a really challenging one. In fact, I don't know that it's really been done at scale anywhere yet. And so we view that as something that we're not sure that is actually feasible. And so I'll probably leave that there. I think it'd be interesting to look at-- currently as I understand it, labor is more concerned with 102, more supportive of 1030, and they have a very strong jobs focus.

[00:30:42.30] So that tells you how they're navigating and what they see as the outcomes of 102. On the 1030 side, I guess I'd probably differ with Rebecca a little bit. I don't think these are polar opposite Bills. I could certainly imagine a very, very business friendly Bill that just cuts the sales taxes, doesn't apply any standards, and I don't think that's 1030 at all.

[00:31:01.70] I think it provides a sales tax exemption or incentive in exchange for certain things, such as the water, very rigorous water requirements, closed loop cooling requirements. I think that's actually very interesting that the data center supported that. And Marshall's comments earlier suggested to me that that's where the industry is evolving to.

[00:31:23.57] And some of the newer pieces, the newer data centers can get to a much, much better water usage profile, which I think is laudable. There's also a provision in 10:30 that allows us to do something very similar to what the PUC approved, which is to-- this gets very wonky and very nerdy, and I apologize, but we have a resource planning process that's about a four year cycle, and it takes about four years to get all the way through that, get all the final approvals.

[00:31:49.13] And it's just proved to be like twice as slow as what the data centers feel that they need to come online. So 1030 has a targeted resource acquisition pathway. And it does have clean energy requirements in it. It requires three to one clean energy versus non clean energy or emitting energy, which is what our resource plans look like right now. And those are the ones that got us to 46% clean energy, 80% emissions reductions.

[00:32:16.20] We are rapidly trying, aggressively trying to expand our set of technologies. But the reality is we do have some need for firm capacity, which is best provided through natural gas or thermal resources. I can talk a lot about what we'd like to do to expand that technology set, but we view 1030 as a little bit more flexible.

[00:32:36.14] I'd say we're less vested in the differences here than the data centers themselves are. And we're going to engage on both and see if we can get a good Colorado compromise going here because there may be a solution in sight. The industry is it's nascent. It's nascent, partially because it's paused in Colorado. They're trying to see what we're going to do. We are a question mark state in terms of data center development.

[00:32:58.58] CHRIS WINTER: Thanks for that. Interesting. Marshall, I'm curious if there's anything in either one of these bills that you think will sink well, or maybe stand in the way of the policies that the city of Aurora has put into place or is planning to put into place. And also if the city has a position on these pending Bills.

[00:33:17.48] MARSHALL BROWN: Yeah, Chris. And this was mentioned earlier. Both these Bills have been out there for a little while. They're not brand new, just this year, especially 1030. Aurora invested a lot of time in Aurora Water, specifically last year when it was initially introduced.

[00:33:37.14] The things that Jack just talked about with the water requirements were missing entirely from the initial draft of the bill, and that was extremely concerning to Aurora Water and some other water providers. The evolution was kind of interesting. We pushed back very hard, had a lot of conversations on the fact that the initial Bill had pages and pages of discussion on power, but water was not even really an afterthought in the initial proposed legislation.

[00:34:09.87] So the approach we took was to say, hey, you really need to talk to the water providers. You can't just assume that the water is going to be there and will not be an issue. The reaction, the edits, what ended up in 1030 wasn't exactly what we suggested. But it does show the evolution in the industry where they're shifting to more advanced cooling technologies that will conserve significantly more water.

[00:34:38.69] So we were happy with the changes that were made in 1030. From a water perspective right now, Aurora Water is monitoring both Bills. We think they both work from a water perspective. There are other differences in the Bills. Again, the incentives are state based. Local entities have been providing some incentives on a local basis, but not on a statewide basis. So we chose to stay out of that discussion. We just focused on water. And again, both Bills accomplish some good things actually from a water perspective.

[00:35:18.96] CHRIS WINTER: Great, thanks. Rebecca, do you have anything else you want to add about those pending Bills?

[00:35:23.80] REBECCA WHITE: No, I think it'll be interesting.

[00:35:25.22] CHRIS WINTER: OK, great. Marshall, I'm curious, is the city of Aurora providing local incentives for data centers? And I guess I'm just curious to hear more about the city's perspective on data centers more broadly, not just the water question, but how is the city thinking about data centers in context of the city's economic development strategy and those kind of broader issues?

[00:35:46.39] MARSHALL BROWN: Yeah, that's a harder question. I am not necessarily the economic incentive person. We do-- so the water utility has a lot of conversations with her economic development folks. Aurora has provided some incentives for some of the data centers that have come in. The eight data centers that we've got have come in-- I think the oldest is maybe 25 years old now, so it's been there for quite a while.

[00:36:15.21] And again, that's the very inefficient water data center. The newer ones-- some of those receive some incentives. I don't know what the incentives were. Again, I was not in that conversation. We focused on the water requirements and said the incentives need to be very careful not to cross over and inadvertently cancel out the benefit of our water requirements.

[00:36:42.85] And so, again, the recent ones that have come in have embraced the criteria. It was interesting. The first data center that came in under our large water user guide built a hybrid cooling system, we think. A lot of the data centers don't like to tell you exactly what they've done, but from what we can tell, they built a hybrid cooling system and they pushed things right up to the limit that we drew for them and are using about that volume of water.

[00:37:12.42] But the latest data center went all the way to the closed loop system. And they're consuming no water. And the conversations we've had with economic development and the data center people has confirmed what Jack mentioned, that the technologies are evolving and regardless even of restrictions like Aurora has put in place, they think that the industry is going to be a lot more water efficient in the future as they go to more direct chip liquid cooled technologies that are more efficient for them. So it's interesting. But yes, we did incentivize some data this summers.

[00:37:53.89] CHRIS WINTER: Interesting. Stacy, maybe just to circle back with you to see if you have anything you want to add about the legislative proposals before you move on. I have a couple of other questions, but I just wanted to wrap up this part of the conversation first.

[00:38:07.24] STACY TELLINGHUISEN: I'm not sure that I have much. I think I would agree with the other speakers, that because Colorado doesn't have a ton of data centers, we have this opportunity to get it right. And so there's this window here, where I think we can shape data center development in Colorado. So again, I think we'd like to see these data centers help advance our clean energy and our climate goals protect customers. So I do think that there's an opportunity. I think the legislatures-- the legislators see that too.

[00:38:36.89] CHRIS WINTER: Great. So I have-- just pivoting to another policy, concrete policy conversation, the president this week, I think, announced a ratepayer protection pledge, which had been entered into with some of the larger data center developers. And so it's interesting because we've also now heard conversations about Xcel working with PUC, about a large customer tariff, which of course doesn't directly involve the data center developers.

[00:39:05.58] And so I'm curious to hear from our panelists, what your reaction is to the president's announcement. How meaningful you think that agreement is, and what we need to do to implement that kind of agreement to build in some transparency and accountability and verification. And so maybe I'll pass that off to Rebecca first.

[00:39:26.32] REBECCA WHITE: Oh, boy. I think what the president said and committed to, is exactly what we want to try to achieve in Colorado. And that's what I think will be debated with the large load tariff. We really need to protect residential customers. And right now where we're sitting in Colorado, rates are about-- oh, Jack-- 8% to 10% below the national average, I think, in Colorado?

[00:39:55.21] JACK IHLE: Yeah.

[00:39:56.33] REBECCA WHITE: So energy, writ large, is very affordable in this state right now. And we really want to hold on to that. And I'd say so that is one of the primary tenants at the PUC as we

debate this, is energy affordability. And the other piece is progress towards our clean energy goals and not moving backwards.

[00:40:18.63] So the interesting thing about the PUC is that's where this all really happens. We are the regulator in this space and that's where it'll get figured out. But certainly, some of the dialogue around how important it is to protect ratepayers, I think, is helpful.

[00:40:37.37] CHRIS WINTER: Thanks. Jack, do you have any reactions to that or thoughts on the ratepayer protection pledge?

[00:40:42.91] JACK IHLE: Yeah, it's a great question. And really it reflects how dynamic this environment is. Major development even this week. I think that it was interesting to me because we've heard a lot of interest in having the incremental cost. It's a wonky discussion, really, but basically assigning the full cost of data centers to drive on the system, onto the data centers. And we have no dispute with that. And we didn't have any dispute with that before either.

[00:41:09.64] It was interesting to me. I heard that more, maybe on the left side, or maybe this is just the states I operate in. And so, to see that come in from another part of the political spectrum, I honestly think that debate is pretty much over. We will certainly have tactical debates about exactly how we propose this structure, which is, it's the art of assigning the cost. And we've done this for 100 years.

[00:41:31.46] New customers enter the system and you add cost to the system, and then you have to decide how those costs are allocated. And you decide amongst residential customers, small commercial, large commercial, industrial, and now we have this super class of very large industrial ish loads. So it's a old exercise. It's a new version of this.

[00:41:53.36] The new version will reflect a more incremental cost basis. Historically, it's been done more on an average basis to average the rates as new investments come in. So it's an interesting crossroads where we have the largest loads we've seen coming in at a time when the infrastructure is also much higher cost than we've seen. We've seen 50%, 100% cost increases, much to my chagrin.

[00:42:18.12] And Rebecca's, because we've had to come in and say the cost went up. I'm very sorry, but this is the true cost of adding to the system now. And that is a fact. And that's what the market's doing. So we're doing that at that timing, but we are seeking to charge the customers at that rate. Let's call it the current cost rate for this new class of customers, which would be a little bit different than historical.

[00:42:39.12] So I do think the debate is largely aligned, honestly, except for the specifics. Now we'll see when we bring that in and we're seeing the same thing across five states. We're deeply interested in customer protection on this. Our rates are below the National average. Our Bills are far below the National average. We're about 37% below

the National average on average electricity bill in Colorado, in our system.

[00:43:02.97] It's partially climate and it's partially our policies on efficiency and other things. So we have a good track record. We really do want to support it. If people perceive that the data centers are directly driving their bill up, I think it's going to be a much more challenging and volatile environment to do any of this. And I hope we get to some point where we can talk about the value of data center development too, because we have some things to say. So, yeah.

[00:43:27.21] CHRIS WINTER: Great. Stacy, do you have any feedback on either the president's announcement, the idea, but also the nuts and bolts of how we might actually see this happen and roll these policies out and maybe what the role of the actual data center developers is in this conversation, at this point.

[00:43:44.42] STACY TELLINGHUISEN: Yeah. I think I generally would agree with what the other panelists have shared. This affordability issue is key. It's key just from a fundamental standpoint of families being able to afford their energy Bills and small businesses. But also from a climate perspective, electricity has to be affordable to be competitive, to electrify transportation, and our buildings, and industry as well.

[00:44:06.34] So I think it cuts across many, many categories of importance. I think what we see is the policies that are enacted at the Public Utilities Commission or at the state legislature are-- they're regulations. They're real, and they're much more meaningful, I think, than a pledge that gets signed in the National level. So I think that that is where we see the rubber hitting the road.

[00:44:32.88] And on that I would say, I think it's easy to agree to certain concepts like, a data center has to sign a contract for its energy for a certain amount of time. And I think that the real challenge is in figuring out what those details are. Is it a 10 year contract or a 15 year contract or a 20 year contract? Because those have really different cost implications. And what portion of the data centers demand are they responsible for paying for? So I think that those are the types of details that are being wrestled with at public utility commissions all over the country, red states and blue states and everywhere in between. And Colorado will be wrestling with this spring.

[00:45:17.76] CHRIS WINTER: Thanks. I think there's a lot of interest in better data overall on the impact of data centers and resource use. And so, Marshall, you referred to this earlier, where the city of Aurora has some pretty interesting data on water use. And it also sounds like you're still working to figure out how to get even better data from your customers. And so I wonder if you could talk a little bit about, what kind of data is available that might be able to help inform some of these conversations? And any reflections you can share on your efforts

to collect that data over time, or to improve the exchange of data with your customers?

[00:45:53.84] MARSHALL BROWN: Yeah. So the data we have readily available to us, is their water use data. So the meters now. And Aurora has AMI or Advanced Meter Infrastructure, where we can collect data on 15 minute increments. So we can tell how much people are using in a lot of refinement. What we can't necessarily tell always, is what they're using it for.

[00:46:24.50] So we have a lot of historical information on what irrigation demands look like or things like that. But we don't necessarily-- if we send water through a meter, we can't tell necessarily if it's a shared meter, how much is going to irrigation versus evaporative cooling, if it's on at the same time. So we would have to get that data from the end user.

[00:46:55.05] The other thing that's been a little challenging for us and a question that hasn't come up yet, maybe it was going to come up later is, if you create a lot of-- and we hear this all the time. Everywhere I go and talk about this, I get this question-- we create this huge savings on water. But what's the impact on the power load associated with switching from evaporative cooling to refrigerant or closed system cooling.

[00:47:19.57] So we don't have necessarily the data on the power usage. We have industry wide numbers that are published. And so we know they're saving 100% of their water. And we know how much that water is, the volume that they're saving. But for the energy increase in consumption, we have very unrefined data.

[00:47:45.06] So we have numbers out there that say, oh, it's probably between a 5% to 20% increased energy demand associated with the cooling, but the cooling is only a 30% portion of the electrical demand for the facility. So we can roughly say you're saving huge volumes of water-- 90% to 100% of the water use at the facility-- for an almost negligible bump up or increase in energy.

[00:48:24.46] But we don't have the actual numbers or the data to say, here's the exact energy increase compared to the exact water consumption. So I can tell you the water savings, but I can't tell you the exact energy increase. But it is small. And we visited with some of our data centers and said, hey, will you share that data with us?

[00:48:47.61] And they're like, well, no, but we'll confirm-- if you push us enough-- we'll confirm that it is a negligible impact for the increase in power demand. And we've said, well, can you define negligible? No. So it's been a little bit limited. But they have confirmed that it is negligible. The next discussion we got into with them was, well, if it's negligible, why isn't everybody just installing closed loop refrigerant based systems?

[00:49:24.87] And the answer to that was a little bit concerning. It's that water is too cheap. We don't price water. So because we don't charge enough for water, the power, even though it's negligible, the increase in power demand is a little bit more of a financial impact to them than the savings of water, even though the volume of water they save is huge. So that's a little bit concerning.

[00:49:59.31] CHRIS WINTER: That the gears are turning hearing that. Jack, I think you had something you wanted to share.

[00:50:06.02] JACK IHLE: Marshall and I were talking just before the panel, and it's sort of ironic, but also maybe an opportunity or a gap because he's told me what he just told the panel in the audience. And I really have the same experience. I don't know what they're using for water necessarily, and I don't get an A B.

[00:50:23.98] Here's my data center with a less efficient cooling system, and here's my usage with the more efficient cooling system. And therefore there's, whatever, 30 megawatts more for the more efficient cooling system. I don't know. And agree 100% that the amount of sensitivity around the intellectual property is super high with this type of customer. I was actually surprised you said the megawatts of a data center, because I usually cannot, and I'm under pretty restrictive non-disclosure agreements about a lot of things.

[00:50:54.35] So I do think there's an opportunity for us to learn more about this. It doesn't feel like these facts are known as well as they could be. And maybe someday soon we'll find the right partner who can be that intermediary, who can display a little bit more openness to doing that, to help that industry fill us all in here. [LAUGHS] It would be nice in a few ways.

[00:51:19.79] CHRIS WINTER: Yeah, Stacy. I know that WRA has also talked a lot about the need for better data transparency from industry and this inverse relationship between water use and energy use. And so I wonder if you can share with us whether you think we're making any progress on that front. Have you seen any forward momentum or do you share some of the concerns that Marshall just expressed about pricing of water resources and how that might relate to this overall picture?

[00:51:43.73] STACY TELLINGHUISEN: Yeah, I do think that this data and transparency is a real issue. And as I mentioned earlier, Senate Bill 102 would address that, but just for Colorado, not at a national level. There was an interesting study out of Central Arizona that compared two data centers, one that was wet evaporative cooled and one that used dry cooling, not the liquid immersion cooling but dry cooling. And that provides some insight into these trade offs in energy and water use.

[00:52:15.05] The evaporative cooler-- the wet cooled facility had flat energy demand around the year. And this dry cooled facility had a

much higher spike in energy demand in the summer, which aligns with the summer peak for the rest of the electricity system. I guess from a policy perspective, we don't see value in setting an explicit, you have to use dry cooling, because there are these trade offs.

[00:52:39.90] We really think it's a decision that is on a case by case basis, depending on what the available renewable energy resources are and what the available water resources are and those tensions. And so I think I guess that just gets to, it's not an easy answer. And having better data from the data center customers themselves would help us better inform what the right answer is going forward.

[00:53:05.84] CHRIS WINTER: Great, thanks. And Rebecca, does the PUC think through this question at all about the trade offs between water use and energy use, or you really just narrowly focused on regulation of Xcel and it doesn't really factor into the work much?

[00:53:18.24] REBECCA WHITE: Yeah, good question. I mean, we are not a water regulator. So we're certainly aware of the broader environmental implications. But we really, really just have the purview over how much energy they're going to use. Thank goodness.

[00:53:34.47] CHRIS WINTER: I'm going to open it up to questions. We still have about 10 or 15 minutes. And I promise to leave some time. And so I know a lot of folks have questions. So let me just check in first and see if we have any students in the room who want to jump in with a question. Any student questions? OK, great. Here we go. Right here.

[00:53:57.85] AUDIENCE: Awesome. Thank you, guys. Just going to walk through a little bit of thoughts from the whole thing we've all been through today, and then give you the context of the question here. So earlier, we were told that this is like a land grab. This is a potential we're going to build out too much infrastructure and that the people might be responsible for that.

[00:54:17.23] And then I'm telling-- I'm being told right now that water may not be a major issue, as we think. In that energy, we're capable of bringing them in. So the real issue or reason data centers hasn't been in Colorado is because of our regulations. My question is, why do we need to even bring them in if the rest of the country is making this gamble. Why does Colorado need to jump into that?

[00:54:41.64] CHRIS WINTER: Good question. Anybody want to weigh in on that? Jack?

[00:54:45.40] JACK IHLE: I can give maybe a couple of examples why we're intrigued by it. And I had testimony on this too in the JTS proceeding, where we can do more than protect the customer. I think we can benefit the customer if they come in. And the reason for that is you should be able to spread more megawatt hour sales, more revenues across a fixed amount of infrastructure. It's like, we're going to build X amount of fixed infrastructure.

[00:55:08.26] If I can provide more energy sales across some elements of that, they will add to the fixed infrastructure without a doubt. But if we can spread some of the sales across some of the fixed infrastructure we'd already be implementing or have already built, there's an opportunity to actually provide customer benefit, number one. And then number two, I'll just give an example this.

[00:55:30.93] About 10 days ago, we made an announcement. We have worked with Google in Minnesota to do a really cutting edge contract in our view, where they're driving significant clean energy, 1,400 megawatts of wind, 200 megawatts of solar. But to me, what was really interesting is 300 megawatts of what's called long duration energy storage.

[00:55:50.83] Now, for those not steeped in utility nerdiness, that's a battery that lasts longer than four hours. In fact, this one would last 100 hours in terms of duration. And they were willing to make an investment on that technology. It was a 300 megawatt battery. We've done some commercialization on two of those batteries that are each at 10 megawatt scale.

[00:56:10.83] So we made some first steps or taking some first steps on that. In collaboration with the PUC, there was an approval that we've got about two years ago, three years ago on that. But Google was willing to step in and completely underwrite that next step of increasing the scale by 30-fold. And that was very, very impactful to me, where you've got this sector, and it's kind of one of the reasons I took this job, frankly. It's super well financed, it's super innovative.

[00:56:37.88] And they can take a more-- they can use their risk appetite in a way that I can't do. I get the same return on equity if I'm investing in a wooden pole or the most advanced generating plant in the world. In other words, it's completely indifferent to risk.

[00:56:53.72] Now they can move in and start to do these commercialization exercises-- or invest-- not exercises, genuine investments, to drive some of the technologies forward that I will frankly get-- I will struggle to get approval from the PUC for good reason, because they're riskier, and it's a little harder to balance those risks with our investments and with the general customer base. It's harder to figure out where to allocate those risks.

[00:57:19.99] I can bring in a partner that has risk appetite and finances. We have a different opportunity to advance technologies from long duration energy storage to geothermal, which is precisely nowhere in Colorado on power generation to lots of other things. So that's why I'm excited about it and excited in drawing them in here and excited to partner with them at Xcel Energy, because we want to do those types of deals to keep the clean energy progress going that we have started.

[00:57:45.75] CHRIS WINTER: Rebecca, you're over here nodding. Are you in 100% agreement with Xcel on this?

[00:57:49.73] REBECCA WHITE: I am a little scared when the regulator is agreeing with the regulated. [LAUGHS]

[00:57:54.95] JACK IHLE: Our mission is the same Rebecca, geez.

[00:57:58.96] REBECCA WHITE: But I do agree with Jack. I mean, those are two key benefits. Can we use data centers to put downward pressure on rates that would be phenomenal to achieve. And can they bring in some-- jumpstart some of these technologies we would love to see at scale geothermal in Colorado. And having an industry that's willing to take that risk and have the money to bring, I think is exciting.

[00:58:24.26] The third, I think, possible benefit I'll throw out there is, these are very large sources of energy use, as we've all talked about today. But if they are willing to interrupt their service when we have an energy emergency, I think there's potential there as well. Texas is already, I think, requiring this for their data centers.

[00:58:47.08] But if they're able to go offline and go to backup power, and we got to figure out the generators. But when we have a crisis, we have a wildfire, we have a huge snow event. And you freed up all of that energy use you've built for the data center. I think that might be interesting, especially in a changing climate world.

[00:59:05.70] CHRIS WINTER: I'm glad you mentioned that. As somebody who has struggled with long outages due to Xcel having to de-power the grid in recent memories, I think that's a really good and important point for us to keep in mind, which is safety and reliability in the face of all of this additional load. Stacy, do you have any thoughts on the benefits of data centers?

[00:59:25.57] STACY TELLINGHUISEN: Just briefly, I have a couple thoughts. I think we probably differ on whether we see a lot of opportunity for downward pressure on rates, but I think, that's to be determined. But I think we share the sentiment of this could bring new, emerging, clean technologies.

[00:59:42.33] And I guess I would say, I think they're coming based on at least Xcel's load forecast in the JTS. So I do think we need to prepare for them. And then finally, I'll just note that from a climate perspective, just seeing them located in other states that have looser regulations doesn't benefit us.

[01:00:00.65] There's the Stargate project that is being developed in Southern New Mexico that will have three to four gigawatts of behind the meter, simple cycle gas turbines. And from a climate perspective, that doesn't benefit any of us. We'd be better off having the regulations in place to enable those data centers in a state that has real clean energy goals.

[01:00:23.37] CHRIS WINTER: Thanks. Marshall, do you see benefits from the perspective of water rates? Water-- you know the municipal water system in the city of Aurora, do you think about this the same way?

[01:00:33.95] MARSHALL BROWN: From a water perspective, and the question was interesting. There are local revenue benefits to municipalities. So you have a steady stream of revenue. Municipalities are dependent. So the general fund budgets are dependent upon those regular streams of revenue. And data centers can provide some benefit from that perspective, adding revenue to the local communities that they end up in, which is one of the reasons why some local communities will choose to incentivize those.

[01:01:16.24] I'll go on a little bit of a tangent. From a water infrastructure perspective-- and you mentioned building out infrastructure that could then be interesting-- another reason to be very intentional with the water demand associated with data centers is if you build a large demand on a water distribution system and then that demand goes away, you immediately inherit a water quality problem in the distribution system.

[01:01:44.74] So if the data center industry is truly evolving into more efficient cooling technologies and the volumes of water they need, reduce after the infrastructure exists, the water providers end up with a water quality challenge in the distribution system associated with disinfection byproducts.

[01:02:06.30] So that was another thing for Aurora. We said we don't want temporary large water users anywhere in our system. We don't want to inherit new water quality demands. You have what are called data center rows in various states. Virginia was mentioned earlier. When I met with the folks from Virginia, I was cringing thinking about the evolution of technology.

[01:02:30.57] They have huge volumes of demand on their distribution system associated with data centers specifically, and then they have tangential demands on that same system. If that data center demand goes away, I don't even know what they're going to do. They're going to have a problem.

[01:02:47.61] So there are good reasons to be very intentional with policies. It's a good thing that Colorado is not quite as far along in this space. And we're thinking about how to be intentional and to put protections in place from a water perspective and from an energy perspective.

[01:03:05.37] CHRIS WINTER: Great, thank you. Additional questions. Dale, I think you have a question.

[01:03:14.28] AUDIENCE: Oh thank you. Very interesting panel. Very interesting day. I don't want to sound alarmist, but one of the things we

have to think about is the resilience of this entire infrastructure. And I am very worried about non-state actors, for example, launching deliberate attacks on the infrastructure. And being around the policy, I always worry there may be a crack here between the different people who are interested in water interests and so forth.

[01:03:51.66] What we may not think about enough is deliberate attacks coming from non state actors, for example. And I'm just curious that I have no desire to create any alarmist, but could you give me a little reassurance that somebody is thinking about. We've all painted this wonderful picture of what could happen with all this AI and so forth. But is anybody thinking about that in a deliberate fashion.

[01:04:29.81] CHRIS WINTER: Anybody want to answer that question?

[01:04:33.54] JACK IHLE: It looks like everyone's looking at me. I think it's a little different focus. I think a lot of the focus here is about how to develop data centers and how to do that the right way in Colorado. You're raising an issue that is AI driven. And we are absolutely, very focused on our cybersecurity aspects, as well as physical security aspects.

[01:05:00.33] I think AI will exist and I think it will enable some good things, but potentially, some bad things as well. We have all I guess-- I can't give you detailed stories about this, but we have a chief security officer. They come out of these sectors, our staff who does that, it's a big staff. Some of them are in our building monitoring this all the time around our physical and cybersecurity infrastructure exposures, if you will.

[01:05:29.26] AUDIENCE: [INAUDIBLE]

[01:05:35.74] JACK IHLE: I am as well. We get deliberate, malicious attacks, multiples every day, on our IT systems. So it's long been part of our operations to understand that, recognize that. We're certainly aware that there have been attacks that have taken down power grids in other countries. And sometimes small, small parts. There have been attacks here as well.

[01:06:02.26] So it's a big ongoing challenge. And that challenge will persist if we develop zero additional data centers in Colorado. That challenge will be, I'd say, really the same challenge. So I don't know if I helped you, and I'm not exactly the right person to help you, but it's a very legitimate concern that you have.

[01:06:20.07] CHRIS WINTER: Marshall, did you want to add something as well?

[01:06:22.67] MARSHALL BROWN: Yeah, I can add that yes, we spend a lot of time looking at the risks for our systems. Large water utilities and electric utilities have significant efforts that we put in to ensuring that we have redundancy, resiliency, and protections in place for our infrastructure.

[01:06:46.43] We partner with some interesting organizations at different times to come in and do evaluations for intentional attacks on our cyber and physical assets. Some of those agencies tell us we're not supposed to tell anybody who they even are. But we partner with them and do various different risk analysis, and drills, and all kinds of things. There are a lot of potential real threats out there, and we're very intentional with how we try to prepare for those.

[01:07:21.22] CHRIS WINTER: Thanks, Marshall. We have time, I think, for one more question. I think right over here. Yeah.

[01:07:29.18] AUDIENCE: This is kind of going sideways a bit on. But with all the discussion about the outgrowth of the eco-friendly environments with wind and solar, the impact on our land and on our animals in Colorado is massive in terms of the potential death of the animals, the death of the birds, et cetera. What is the PUC, as well as Xcel doing, or anybody here on the panel, doing to mitigate the impact in our state?

[01:08:02.92] REBECCA WHITE: You want me to take that one first? Yeah. So super good question. And you're absolutely right. There's just a lot of development going around, especially in the Eastern Plains, that have hasn't seen this type of infrastructure coming in. Where the PUC's role is not to determine where let's say, a solar field is located. It's more the costs and the benefits of what that's providing to customers.

[01:08:33.25] So we don't get involved in siting. I will tell you, this is a very active discussion in Colorado with Department of natural resources and Colorado Parks and Wildlife and Xcel, certainly when they go out and build, have to get the right permits and do the studies that are required, both those state or locally. So maybe, Jack, you can expand on that a bit?

[01:08:55.85] JACK IHLE: Yeah. It's a great question as we've sought to reduce carbon emissions. Those are more local or more centralized generating units in a lot of ways. Now that we've moved to wind and solar, it's absolutely taking up more acreage of land to do some of that. So it's one of those trade offs and it's going to become a bigger issue. And you flag that.

[01:09:19.46] And frankly, I think the AI demand is it's going to increase that to some extent. And our last JTS-- sorry, our resource plan, which was called the Just Transition Solicitation, we had portfolios that range from 5000 megawatts to 14000 megawatts. It was just-- it was a scale that we'd never seen. And it was a combination of things, including the demand growth. And that's just a different scale than we've had before.

[01:09:47.16] As far as mitigation or managing that, there's a lot to it in terms of just species management. So for a wind farm, for instance, there's a lot of site monitoring for avian impacts. There is a lot of

assessment on critical habitat for things like the lesser prairie chicken, where we've participated in area swaps and things like that to manage that. And I know that they're using monitoring systems.

[01:10:17.26] There's some sort of live curtailments of the wind farms when sensitive species are known to be flying nearby and those sorts of things. So it's evolved a lot. There's not really a zero impact energy source. And so we're seeking to minimize that. But I agree with you, that land use is going to become a larger concern as we move to more land using renewable energy technologies.

[01:10:42.70] AUDIENCE: So is there any [INAUDIBLE] With the minimal amount of solar, what you're talking about-- you're talking, what? 3000 or more panels. 5000 panels. And so it's-- is there any rethinking of the PUC or in Colorado to look at going back to natural gas, which doesn't have that impact on the animals? Because I feel like we're almost taking ourselves and putting ourselves in front of the land and the Earth in some of the other things that we're doing, because or how we view the climate change.

[01:11:35.28] JACK IHLE: We haven't gone away from natural gas particularly. So I don't know if we're going back to it, but I hear the question. We're doing the things that I mentioned that we're doing. Where this goes long term, you are definitely seeing across the industry a lot more interest in seeing whether we want to do more nuclear. That is a more geographical, central.

[01:12:00.02] It produces an awful lot of power for a certain amount of land area, and it doesn't emit carbon. We have no tangible, serious proposals in Colorado for that. We do too, operate two nuclear plants in Minnesota. So it's something that we evaluate. But at this time, our best technologies are wind, solar, batteries and natural gas. And that's why I'm so passionate about expanding the option set.

[01:12:23.68] I think geothermal could be pretty interesting. And it won't have that large land area usage. So we're really interested in that. So there's again, no impacts. There's no technology that doesn't have impacts. And we're going to have to figure out how to balance that. And it's probably a bigger challenge now. I'd love to hear from Stacy on this because I bet you have some land use thoughts.

[01:12:44.42] STACY TELLINGHUISEN: Yeah and I'll say, to be honest, I'm less deeply involved in our lands programs worked to try and guide the siting of renewables, we do see it as really critical to protecting critical habitat, waterways, et cetera. I think when we look at getting to 100% zero carbon energy by 2040 or 2050 across the region, the build out-- if you're relying just on wind and solar and batteries-- the build out is staggering and becomes even more challenging, I think, with these data center loads.

[01:13:19.63] And so I think that informs Western resource advocates. Thinking on this, we're very excited to hopefully see geothermal start

to expand, but it's caused us to also wrestle with this issue around nuclear. And we don't have a firm position yet. But I think that we remain open to it.

[01:13:39.33] CHRIS WINTER: Rebecca, do you have any closing thoughts on that question?

[01:13:42.19] REBECCA WHITE: No.

[01:13:42.53] CHRIS WINTER: OK. Well, I think we're out of time. Please join me in thanking our panelists.

[01:13:46.99] [APPLAUSE]