Anna Gassman-PInes:

From the Sanford School of Public Policy at Duke University, hello. Welcome to Policy 360. I'm Anna Gassman-Pines. Data centers are huge structures, they hold computers and equipment that are the backbone of the digital age. They make possible the computational power and data storage needed to train AI models, store content, and operate the cloud-based services that many of us rely on. There's also hope that data centers and the innovations that come from them are key to solving huge issues facing the world right now.

But data centers also prompt a lot of environmental concerns from pollution to massive water consumption. Today, we're going to talk about a certain type of data center. They're called hyperscalers, and they're run by companies like Amazon, Google, Meta, and Microsoft. And a surprising new Duke report says that hyperscalers could actually be good for the environment. They could become mobilizers of clean energy and updated grids. The report's authors are Merritt Cahoon and Ian Hitchcock from the Deep Tech at Duke Initiative. Welcome to you both.

Merritt Cahoon:

Thank you. Happy to be here.

Ian Hitchcock:

Thanks for having me.

Anna Gassman-PInes:

So Merritt, did I get it right? What are hyperscalers?

Merritt Cahoon:

So hyperscalers themselves are these massive companies that you mentioned. So your Amazons, your Googles, your Metas, your Microsofts. And they are these large-scale cloud computing providers that operate these massive data centers. So we have the hyperscaler, which is the company itself, and then the hyperscaler data center, which is kind of that physical infrastructure. So we have focused on these hyperscaler data centers because their massive build out is really contributed from AI and data analytics and digital transformation, both in government and industry. So they're just these massive, massive buildings that hold a ton of compute power.

Anna Gassman-PInes:

And Ian, big companies are developing more data centers. Is that right?

Ian Hitchcock:

Absolutely. We're seeing with the rise of various AI-affiliated tools the data centers are used to power, that the demand for data centers is just skyrocketing up, and up, and up and placing tremendous pressure on the natural resource bases that they depend on in order to function. So that's the reason why we focused on energy and water as the dual pillars of our focus, because increasingly, when you combine this massive pressure to build new data centers. Not only to meet domestic demand, but also to compete internationally, to try to win the AI race with China, which seems to be a big motivator in US federal policy at the moment. And also to power not just the shiny new AI LLM tools, but the existing cloud infrastructure.

So one of the reasons why Northern Virginia, for instance, is a hub of the highest concentrated data centers in the world is because these companies use that area to power the requests that people have for day-to-day use of the internet. You stream a YouTube video, you go online on Facebook, those requests get processed through a data center. One of the things that's different about the way that the hyperscaler data center build out is going is that unlike those data centers that are the heart of the internet, the conventional data centers that need something called low latency. So basically a very slow time between the time a request goes out and the time a response comes out, the hyperscaler data centers being used to train AI models don't need low latency, which means they can go just about anywhere that has the land footprint and the energy footprint to accommodate them.

And that's part of why we're seeing hyperscaler data centers being built out in rural areas of the country, in places where communities may not be used to having large infrastructure. And it's raising a lot of questions about how these large industrial users are contributing to the communities and what they're taking from them.

Anna Gassman-PInes:

Okay. Right. So let's talk a little bit more about that. What could communities see both good and bad from data centers like these? Merritt?

Merritt Cahoon:

Yeah. I struggle to go straight to the bad, but I'm going to start with the bad. A lot of these data centers, one of the examples we use are Arizona and Texas. They're in these places that do not have enough water to support these data centers, but they're in areas of land that are cheap. So they're buying plots of land in these cheap areas where they can build this infrastructure, but they're taking up water resources from communities. So to start with the bad, that's going to be one of the big ones. Yeah.

Anna Gassman-PInes:

And can you help us understand why these data centers use so much water?

Merritt Cahoon:

Water, it's right around 40% to 50% is used for cooling these data centers. And because they're using so much energy, we have to cool down the different pieces that they're using within these data centers. You can use that through electricity and air, but it's more efficient to use water. So we're using water to cool these data centers and to make sure that they are continuing to be able to be used in long periods of time.

Anna Gassman-PInes:

Okay. So this is like when I have my laptop on my lap and it gets a little bit hot, but on a massive scale. Am I thinking-

Merritt Cahoon:

Yes, exactly.

Anna Gassman-PInes:

... that in the right way?

Merritt Cahoon:

Exactly. Yeah.

Anna Gassman-PInes:

Okay. And can one of you help us think about, okay, so I'm hearing some negatives, but are there any positives or good things that could come to communities who are hosting these data centers?

Ian Hitchcock:

Certainly. One of the benefits immediately is there's a spike in some short-term construction jobs, somebody has to build the things, and that can be a win for communities. Depending on how the deal was made to get the data center sited in a particular area, they can obviously be contributing to the local tax base. So that can be a big boon depending on if that is happening. I give that a caveat because one of the things that is driving data center land development is communities competing to receive a data center. And one of the ways they're doing that is by offering different kinds of tax incentives, which may or may not negate that issue. And I think this kind of gets to one of the things that's most challenging to generalize in this space because different corporate actors have very different practices. So if a hyperscaler comes in, a Meta, say, has an agreement to provide some extra funding to communities in the arts or their schools that they do voluntarily, that's great and that's a definite boon.

But what we don't have is, one, great transparency around what communities can expect to see, kind of a shared experience that we can generalize across, or requirements about more specifically what some of those community benefits could and should be. You'll hear the companies themselves talk about what those benefits are and they may well be real, but when you're thinking about economic development, the lack of transparency makes it difficult to assess those claims. And this is also new that we're kind of waiting to see how it all plays out. I will say this is not necessarily tied to a benefit to specific communities that are hosting data centers themselves, but for the grid and society as a whole. One of the other things we really wanted to highlight in the report is the potential strength and opportunity of the demand signal that hyperscalers are sending for something we call clean firm power. Which is essentially renewable energy that unlike traditional wind and solar is not intermittent, but can be kind of ramped up and ramped down to meet demand fluctuations quickly.

One of the main bottlenecks for hyperscalers right now is access to energy. We're seeing a lot of difficulty with them connecting to the broader grid, and there is a tremendous amount of innovation and interest at play to try to help solve that problem so that they can get their speed to market, so they can win the AI race and that energy isn't considered a constraint. And so one of the longer term areas that we think could be a benefit to data centers, depending on the choices that are made, is if they continue their investments in next generation clean firm power, things like small modular nuclear power, advanced geothermal, carbon capture. And the amount of resource that's being put into this physical infrastructure really gives us an opportunity to accelerate some investments in the kinds of clean technologies that we need to really help supplement the renewable energy build out and ensure that these things can be an environmental energy boon as opposed to just a major resource extractor.

Anna Gassman-PInes:

Right. Okay. And Merritt, can you say a little bit more about how it might be that hyperscalers accelerate our sustainability goals rather than destroying them?

Merritt Cahoon:

A lot of these hyperscaler companies have these massive sustainability goals, a lot of them looking towards 2030. Ideally, if we move towards these sustainability goals, like what Ian was saying, the demand for sustainability can increase private investment into this clean firm power. So if hyperscalers go one way, hopefully a lot of private investment and some of these smaller companies will also move more towards these sustainable goals.

Anna Gassman-PInes:

And Ian, in the report, you mentioned a paradox. When we improve efficiency, we utilize more resources. Could you talk a little bit more about that?

Ian Hitchcock:

Happy to. So Jevons paradox essentially describes how when something becomes more efficient that might not actually cause one to use less of it, but if it becomes cheaper, people can use more of it. So the typical example that people use is when you're putting more lanes of traffic on a busy highway. And you say, great, we've put more lanes, traffic jams will be slower now, and you're still sitting there for 40 minutes waiting to get to work because the actual demand on the highway hasn't changed. In some cases, it may have increased if people perceive that there's actually more resource to be used. And so that example plays out in a particularly powerful way for data centers because the compute, essentially the processing power, the output, I struggle to see what a limitation on it could be. As we develop more sophisticated AI tools, we've seen even in the last few weeks, kind of a commercialization of everyone creates short-form video as opposed to just LLM text-based prompts, those consume a lot more energy.

And so, I worry that a hyper-fixation on energy efficiency metrics and utilization might obscure the broader implications on higher consumption caused by higher demand. And so I think that while efficiency is a key part of the solutions, and we have seen tremendous innovations in computer processing efficiency, for instance. So the chips can do far more compute for far less power than they could even 10 years ago. Similarly, we're seeing some promising advances on water systems, so direct to chip cooling, for instance, that can be far less water intensive than some of the current practices we see. But at the same time, even if you have the most efficient water-cooled system, if you're still building your data center in an area where there's a drought, where there's a lot of competing water uses and the water runs out, it may not matter how efficiently you use that water if it's not available in the first place.

And so, we wanted to kind of talk not just about how efficiency metrics are improving, but to say that while efficiency is great, we probably cannot count on it alone to save us from some of these broader implications of data centers and their resource use.

Anna Gassman-PInes:

Yeah. And I'm glad you took us back to water because I wanted to kind of dig deep and talk a little bit more about what's going on in Arizona. There are 85 centers in one region in Arizona and that seems impossible for such a dry state given how much water these data centers use. Ian, can you tell us a little bit about what's going on in Arizona and help our listeners make sense of this?

Ian Hitchcock:

So from what we can tell, the main drivers for a data center location at the moment seem to be availability of power, cheap land, and local tax incentives. And so out west, what you have is relative availability of power, cheap land, and some pro-business tax incentives. And so I think you're seeing an avenue where the existing incentive structures, again, and I keep prefacing this with as best we can tell,

because the lack of transparency here means I'm kind of guessing in the dark. And that's one of the things that we really want to highlight is I would love to be able to better answer your question of how data center companies are making their siding decisions. And if water resource constraints, for instance, are being considered at all, because I have a similar response to you. I'm like, this is crazy. You're going to run out of water at some point. Let's forget about ecological, broader ecological sustainability for a second. You're investing billions of dollars into these boxes of computers where the hardware is the thing.

And if you like that that'd be a stranded asset because you run out of water to cool it, that doesn't seem sustainable to your business, let alone to the environment. So at the moment, I think the water constraints in those communities are causing a lot of pushback. We are no longer in the area where a data center comes to town and communities say, "Oh great, this is [inaudible 00:13:16]. We haven't seen anyone build in our area for a while. We're so excited." One example we go in the report, a bit of a forward-looking community, there's a town out called Chandler, Arizona, that in 2015 essentially banned the usage of water intensive infrastructures, at least without further insight and review from the community. And that's effectively resulted in Chandler being an area where data centers are going up all around, but not one where within their municipality those things are happening.

But one of the other challenges in this policy landscape is that we see this very piecemeal approach, and it's one that seems very reactive rather than proactive. And so what we're hoping to do with this research and other research is just try to help equip policymakers, community groups, data center developers themselves to think through what are the actual implications of siting a data center in a particular place? Because one of the main decisions they can make to be more or less sustainable is where they choose to site these things. And that will depend on how much water they need, how much energy they use. Google loves to tell the example of a data center in the Netherlands where they can use very little cooling power because it's already cool there. And that's great.

And it's unclear to me how we shift that from an industry kind of shining example, a diamond in the rough, to a broader practice, but I think that's something that policymakers increasingly need to think about. We're seeing it on the energy side, in part because I think we've got this infrastructure of electricity grid connections, load requests coming into utilities, utilities being terrified they can't meet them. And then people's electric retail rates spiking already, and that creating a lot of political pressure. And so that's created a lot of the energy and interest and conversations around energy in data centers. We haven't seen that thing in water. I think in part because we don't quite have the same infrastructure to allow those concerns that are often very local to bubble up into bigger policy arenas. And so while they may have hyper local impacts, they may not be as immediately clear to a regional or state level policy maker. But we need folks to be asking those kinds of questions, especially in places like Arizona.

Anna Gassman-PInes:

Right. And Merritt, are there other things, other models that cities could try to think about how they might push for more water conservation when these projects are going up?

Merritt Cahoon:

Yeah. One of the big things that Ian, there are a couple of things that Ian was pointing out to even back to his paradox answer. But one of the things is making sure that the conversation around water conservation is being talked about while you are deciding where to put these data centers. Because a lot of these places are in, again, these hot places with less water. We're looking at Texas, which has their own grid, and that's a big reason why people are putting data centers there. And then Arizona, when you think of Arizona, the first thing you think of is a desert, you're not thinking about, "Oh, they have

this abundance of water." No, you're thinking of the desert. That needs to be a major part of the conversation. And looking with Arizona specifically, you have chip fabrication, so where they build semiconductors and these fabs. TSMC is a big one.

And I think a lot of it is city specific, but also these companies choosing to be more sustainable, but also it comes back to this paradox. So TSMC, for example, they brought their water usage down. They're working on recycling their water. So by 2027, they're going to go from 8.9 million gallons of water per day down to one million gallons of water a day, which sounds great except for the fact that one million gallons of water a day is the same as 3,000 households. So if you're taking water from, say, 3,000 households away, that is not... Yes, it is more efficient than where they were, but you are still taking this great resource away from these people.

So I think, that was the idea with this report is making sure that we are not just thinking about, okay, is the land cheap? Is there energy available? A big question is, is there water available? We can also look at... I mean, this report is very US specific, but looking in Latin America, if we're looking at Brazil, for example, they have so much renewable energy, but they do not have the amount of water to support data centers. So we cannot recommend and say, "All right, okay, on the energy side, it's more sustainable, so maybe we should build them there." We have to weigh both water and energy in the conversation of where we are putting these data centers.

Anna Gassman-PInes:

Right. And what's TSMC?

Merritt Cahoon:

Yeah. TSMC is, they create chips.

Ian Hitchcock:

I believe it stands for the Taiwanese Semiconductor Manufacturing Company.

Merritt Cahoon:

Yes. Yeah, that's right.

Anna Gassman-PInes:

Got it. Merritt, you have a background in tech ethics. The report says only 16% of data centers publicly disclosed information on water related risk management. Do you think there will be more pressure for data centers to disclose sustainability information in the future?

Merritt Cahoon:

Do I think there will be? I don't know. Do I want there to be? Absolutely.

Anna Gassman-PInes:

Yeah. Okay.

Merritt Cahoon:

One of the things that we talk about a lot as well is when we talk about getting data from these hyperscalers and these hyperscaler data centers, we don't want general data. We want granular

community-centered data. So earlier when we were talking about, okay, what are the pros and cons for each community if a data center comes in? Well, that's going to be really different from a data center in Arizona to a data center in Northern Virginia to a data center in Memphis. That is going to be completely different. So we are hoping for this granular data of, okay, we're using this much water, we're using this much energy, but we're bringing this many jobs to the area. We need something very specific to that specific data center, not the hyperscaler data centers at large across the country.

Anna Gassman-PInes:

And do you think that the hyperscalers are open to sharing this information at some point? Is this part of how they are seeing meeting their sustainability commitments?

Ian Hitchcock:

This is an area where I doubt that internal voluntary corporate sustainability goals enough will get communities and policy makers the data they need. This is an area where fundamentally we need regulation and disclosure requirements. And that's not necessarily because the companies themselves are evil, or bad, or malicious. But when they're in very close competition with each other to put out resources on this technological frontier, to have their own innovations, to try to capture a very uncertain market share, even to the point of it being unclear what metrics we might use to assess data center sustainability, for instance. It can be very difficult for companies to put themselves out there and want to be the first mover in case they get perceived as a bad actor. So for not only the sake of the communities where this infrastructure is going, but to help the companies themselves understand how to position themselves, what to monitor, and how to track things like their water use or how that plays into their siting decisions. There is a role for policy here.

And while we may not see it on the federal level anytime soon, there are a lot of ways in which localities can, and frankly, I would argue should be pushing back and asking hard questions. And so I do... And it's interesting, one of the examples we use of when we were trying to extrapolate what's average data center water use, which as we've talked about before, is almost a useless thing because all data centers come in different shapes and flavors and are changing so rapidly. But one of the only places where we could actually find tangible numbers came out of a lawsuit from a community in Washington State suing Google to try to get an understanding of what their water usage was. That is not a sustainable way for us to get information about these things.

It shows what kind of duress companies were under in order to reveal them. I will say, and this happened subsequent to our report, but Google to their credit has since produced some public data around what is the energy and water use impact of a particular usage of their Gemini tool, which kind of is one piece of the puzzle. And so while that is something that doesn't get to Merritt's earlier point of for data center infrastructure themselves, we need to understand what the implications are on those communities. We're not just talking about an aggregate broad-based technology company sustainability report or an average query. Because we're talking about global demand, global access to these services, but very hyper local impact.

Anna Gassman-PInes:

Right.

Merritt Cahoon:

One thing I want to add, and this is also going to be a shout out at the same time, so the professors that we worked with, Jackson Ewing and Tim Profeta from the Nicholas Institute, and then David Hoffman

from Sanford and Deep Tech as well, wrote a foreword for our report. And in part of that said, voluntary corporate commitments must be grounded in measurable outcomes. And I think that's where policy comes into play and pressure from communities comes into play. Because there's a difference in saying something versus doing something and investing in something and executing on it.

Anna Gassman-PInes:

I was going to read part of the foreword back to you all. So what's interesting about your report is that it indicates that we're basically at a crossroads. And okay, so here I'm going to quote from the foreword, "Will we allow hyperscalers to deepen dependence on fossil fuels, strain public resources, and exacerbate environmental inequities, or will we harness their scale, capital, and innovation capacity to help solve some of the world's most pressing problems while driving a sustainable energy future?" Given that, and this is a question for both of you, where do we need tech policy guidance or rules of the road when it comes to hyperscaling?

Merritt Cahoon:

I think this podcast could just be reading the foreword back as well. It's really good. But a couple of other things from that foreword that I think also answers this question is like, one of the things that was also said are technological advances must be paired with public policy reform. And data centers have been around for a bit of time. But the reason this report is important now is because we are seeing this massive build out of these hyperscalers. And so, this is where the conversation needs to be and needs to stay on and solutions, especially when it comes to policy, have to be interdisciplinary and they have to involve business technology. We need policy in there as well. This has to be a wide conversation. And this is another reason why this report was important is because we have people focused on energy. We have people focused on is the land cheap, but we don't have people focused on, okay, is there water availability? So the solutions have to involve a broad audience to be able to come up with policy to address data centers.

Ian Hitchcock:

For my part, I would add that I do think that there are real avenues of collaboration that could be very fruitful if we break down silos. So for instance, the opportunities for electric load flexibility by data center operators is something that some of our colleagues, again, Tim Profeta and then Tyler Norris over at Nicholas Institute.

Merritt Cahoon:

Another shout out.

Ian Hitchcock:

We love to give shout outs to our other colleagues.

Merritt Cahoon:

Yeah, we do.

Ian Hitchcock:

Have written a report that has taken the energy world, at least by storm, saying that there is a lot of potential slack in the grid as it were if we were to reduce large load demand at times of peak grid

demand when everyone's home and turning on their air conditioning, or lights, or whatnot. That if we could get hyperscalers and other large load users to even just by fractions of percentages bring down their energy usage at those times, that could really help alleviate the need for expensive transmission upgrades, for instance. And so that's an area where we already have some technologically possible and feasible solutions, but ones that will not materialize in the absence of authentic collaboration between large load managers, including hyperscalers and utilities themselves. And we do point to some avenues where those collaborations are being built.

So for instance, the Electric Power Research Institute or EPRI has what they're calling a DCFlex program where they've brought together hyperscalers, utilities and are trying to build data center campuses from the ground up with load flexibility as a key design feature from the get go as opposed to kind of an add-on afterwards and also trying to do some of the work of developing standards and practices and things like software that can speak between a grid operator and a hyperscaler. So that's one example, at least on the energy side, of how collaborations are key. We do also think that data disclosure at the end of the day, because we're having to do a lot of what ifs and maybe and speculative, and we're doing that from the perspective of kind of researchers sitting far away from communities, but communities are sitting there going, "What will happen to my tap water? What will happen to my electric bills?" And those are questions that people deserve answers to.

And rather than having governors go to electric grids and threaten to pull out of major markets unless the regulators get their handles on something, we really need to do as a fundamental foundational first step to making progress, ensure that everyone involved has the information they need to make sound informed decisions about the costs and benefits of this infrastructure, not only for companies, not only for tech users, but for local communities themselves.

Anna Gassman-PInes:

It seems really foundational. How can communities decide for themselves whether this makes sense if they don't have any information about what?

Ian Hitchcock:

I would argue that they can't, and that's not a tenable world.

Merritt Cahoon:

I will also say that data centers have been in broader news cycles too. Because rate payers are seeing their energy bills go up because of these data centers. I think sometimes when we talk about data centers, it gets too far from the personal effect, if that makes sense. But this is affecting personally rate payers who are having to carry the load of these data centers and the energy that they're using.

Ian Hitchcock:

I don't know if that punt was intended, but it was brilliant. Carry the load, indeed.

Merritt Cahoon:

I will say that they're not intended.

Anna Gassman-PInes:

I love a pun.

Merritt Cahoon:

But it'll work. I'll take it. Yeah.

Ian Hitchcock:

Just building on that, we are seeing a lot of policy experimentation on this, tariff front especially, in trying to shield rate payers from the broader implications of cost shifting. Large utilities have to develop large loads to accommodate data centers and that causes everyone's rates to go up because the utilities just put that in the rate base and then get based into it, which is another kind of part of the problem, right? And I think part of the confluence that we're in. So when we talk about being in the crossroads right now, we're not just talking about being at the crossroads of the climate crisis of data center development. We're talking about being at crossroads of antiquated infrastructure and antiquated policy frameworks around that infrastructure that create perverse incentives that don't necessarily allow us to quickly and its speed enable the kind of solutions, create the kind of collaborations or require the kind of disclosures necessary to seize this moment.

And so, a lot of what we were trying to do in this report was to point out a few, not only look clear eyed at the costs and implications of the resource use because they're massive, but they're also very uncertain. That's something else. The estimations, when you look at the graphs of, "Yeah, data centers demand could rise by 12% or by 33%, could be 20 terawatts or 300 terawatts." It is insane the cone of uncertainty with which policymakers, communities, even data centers themselves are operating that with. And anything that we can do to reduce that is a good and necessary first step. Those are the negatives. The positives are that the opportunity that this large load presents of tremendous resource investment. You get a fraction of these billions of dollars being going into data centers to help solve some of our climate clean energy problems.

It's not just data centers that could benefit from advanced geothermal. It's not just data centers that could benefit from getting small modular nuclear reactors going. It's not just the fact that data centers could be creating micro grids or islands of resilience that could be... There's an avenue, theoretically, I'm not seeing it happen per se, but when I look at the landscape, I could see if you have a data center in your community and you're dealing with power outages from say more extreme weather exacerbated by the climate crisis and you've got a lot of onsite battery generation, which all data centers have 100% backup generation. They're often diesel-powered right now, awful from an emissions and health standpoint. Low hanging fruit is to replace those with electric battery storage and that can help a lot. But if that happens and these can be thought of as hubs for community resources, Then that is a way in which they can be contributing to the wellbeing of their communities and not just taking resources rapaciously to serve a broad global demand for digital services.

And it's that kind of creative thinking that won't happen in isolation, won't happen unless there's collaboration and creativity, and that we think there is tremendous pressure for it.

This is something that companies and communities can choose to do absent of push from the federal government at the moment. And the reason that we focused on hyperscalers specifically in this report was because their sustainability goals are ambitious, but to the hyperscaler's credit, they seem to have some teeth. They have put more money toward procuring renewable energy, for instance, than they could have for gas-fired energy, in part because they want to meet those renewable goals. And that's an example of ways in which the desire by these hyperscalers to be seen as good corporate citizens when it comes to environmental sustainability gives us an opening. And an opportunity to try to come to them with a solutions-based framework that acknowledges their resource needs, but also presents some opportunities for collaboration and community empowerment. I think there is a lot of potential there

and our hope was that our report can have some small role along with many other efforts to try to make those collaborations happen.

Anna Gassman-PInes:

Thank you so much. I really appreciate that. Thank you both for joining us today. This is a hugely important issue and one that I'm sure policymakers and community members around the world are wrestling with.

Merritt Cahoon:

Thank you for having us. Yeah.

Ian Hitchcock:

Yeah. Thank you so much.

Anna Gassman-PInes:

Merritt Cahoon and Ian Hitchcock both work in the Deep Tech Initiative here at Duke University. We'll have a link to their report in our show notes. The report comes from the Deep Tech Initiative, the Nicholas Institute for Energy, Environment and Sustainability, and Duke Science and Society.

Merritt Cahoon:

We also want to shout out. We mentioned the three professors that worked with us on the foreword. So Jackson Ewing, Tim Profeta , David Hoffman. We also want to shout out David Brown from Fuqua, and the Nicholas Institute, and Sanford's comps teams as well.

Anna Gassman-PInes:

And I want to shout out both of you for being Duke alumni. Merritt holds a master's in bioethics and science policy, and Ian received his master of public policy degree from Duke's Sanford School of Public Policy. Thanks today to Public Policy master student, Robert Ganzert, for his help on this episode and to Producer Carol Jackson. Thank you all for listening. We'll be back soon with more conversations. I'm Anna Gassman-Pines.