TPI SPECTRUM SERIES 2024

30 Years of Auctions: Looking Back and Looking Ahead

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Sarah Oh Lam:
Welcome everyone to our inaugural TPI Winter Spectrum Series. This series kicks off with this panel and a fireside chat later today to celebrate the 30th anniversary of the first spectrum auction by the FCC in 1994. These auctions revolutionized the telecom industry. Don't miss the fireside chat later today with Paul Milgrom, Evan Kwerel, and Scott Wallsten at 4:00 pm. This morning we have a panel here called "30 Years of Auctions Looking Back and Looking Ahead." Since 1994, the FCC has conducted over 100 auctions and raised hundreds of billions of dollars in bids. Countries around the world have also implemented auctions enabling mobile connectivity through these licenses. Today, we will discuss these innovative auctions such as the Broadcast Incentive auction, the C-band auction, and the CBRS auction. Our panelists today are Umair Javed from CTIA, John Liebowitz from Jupiter, and Giulia McHenry from the FCC, and Becky Tangren at NCTA. To start off the conversation, I thought we could look back a bit at prior auctions. The FCC has a nice summary of their auctions online, and while total bids isn't the only way to measure economic value, we can look back and compare the different auctions that way.

Sarah Oh Lam:
The largest recently was C-band that raised $81 billion in bids, eight ORS three with $41 billion and 3.45GHz at 22 billion. How do you each measure or think about the effectiveness of a particular auction or band allocation? CBRS, for example, raised 4,000,000,000 in 2020. But at the same time, bids may not necessarily reflect economic value either. So opening it up to you all, how do you think about evaluating the last 30 years of FCC auctions? Just opening it up.

Umair Javed:
Well, sure. Happy to kick things off. Morning, everyone. Great to be here. It's great to be here with so many of my former colleagues. Actually, so much of what I know about auctions, I learned from the people on this panel from Giulia, from John, from Becky. So it is great to be together with them again. Maybe before I jump into your question, I'll just say first that I have to admit, that I never imagined we would be starting 2024 with the FCC still not having auction authority.

Umair Javed:
But here we are. And that's just given the wild success of this program and certainly the bipartisan support it enjoys. It's a little bit of a surprise. So I do think that we really need progress this year on restoring the auction program so that the country can continue to move forward. I think that there have been consequences to the United States not having auction authority. I think we saw it at the World Radio Communication Conference, where the US largely deferred to other countries on what bans would be harmonized. I think it has consequences for the administration's national spectrum strategy and its ability to deliver on its vision for the country. Certainly it has consequences for our ability to do things like upgrade military systems or fund the projects that keep Americans safe and connected to the internet. So these are important things. I'm really hoping we'll see thoughtful progress this year. I think as I look back over the last 30 years for the United States auction program, it's just been a wild success.

Umair Javed:
We've held over 100 auctions. Those auctions have raised more than $200 billion for the US Treasury. They funded some of the most important projects we've undertaken, like building out a nationwide public safety network. It's delivered real benefits for the American people. I think about how we consider how to value auctions: is it the revenues? Is it something else? The first place, certainly, that I would go is the fact that we have statutory considerations. Certainly under the Communications Act, our goal is to get the benefits of new technologies to every American all over the country. We balance that goal with encouraging upgrades, new service, but also new entry and competition. We balance it with universal service. There are a lot of statutory considerations. I think that goes into it as well.

Umair Javed:
For me, I think the most important thing is, is our auction program able to ensure that the US continues to lead the world in the wireless ecosystem, and I think that means making spectrum available for the services that need it, and leading the world on, on some of those metrics as well.

Becky Tangren:
Well, I agree with America wholeheartedly that the FCC should have auction authority restored, and it would be lovely to see that just happen so we can all move on from politicizing the FCC's auction authority. But since you mentioned the Communications Act, another statutory requirement is that the FCC increased competition. While auctions can often bring in a lot of revenue, and those have certainly served the public interest, we also have to serve the public interest by ensuring a variety of services. And that spectrum is available to a variety of users and the way auctions are designed and the licensing rules can directly impact that.

John Leibovitz:
So. Giulia, you should go.

Becky Tangren:
Oh, sorry.

Giulia McHenry:
John, do you want to go? Okay.

Giulia McHenry:
So picking it up from the inside in terms of kind of on an auction by auction basis, what are we looking for and what makes it a successful auction. At the end of the day, our success is measured on integrity and reputation. A successful auction is one in which everybody at the end of the process feels like there's integrity in the process; that the process was smooth, that it gave everybody the opportunities to be competitive, and to participate, based on the rules that we lay out, based on the training and the tutorials that we that we create from the beginning, and that the process really is smooth and clear for all participants. To really hit the nail on the head, the reality is kind of what the at the end of the those metrics look like has a lot to do with whatever the priorities of the policy makers at the time.

Giulia McHenry:
Competition is clearly an important one, you know, bidder diversity or are we giving all bidders an opportunity? Does everybody feel like they can be part of the process? And then of course, ensuring along the way on a round by round basis that the better behavior is appropriate and playing by the rules. At the end of the day, from my perspective, the revenues are really exciting. But they are not, you know what? I hang my hat in terms of what a successful auction is. And then I think, think again, and I appreciate everybody saying that we really need auction authority back because you know, so much of the reputation and the excellence that we try to foster in the auctions division really comes from having a constant program, right? Constantly evolving, constantly updating our systems, constantly sort of keeping things moving and moving on and innovating to the next auction.

Giulia McHenry:
And that is very difficult to do when we don't have authority and that in the long run will hurt the American public, and all those participating in the auction. So, really we need that authority on a constant basis to develop all those pieces. And then finally, I think, you know, looking through the 25, 30 years of auction history. I think, really, the mark of success is the extent to which we've innovated in process, learned what works, had another auction figured out with every new band and every new challenge, how to make that work and how to run that. And if you think back to our first auction, that was back in 1994, and it was actually held in the blue room of the Omni showroom. It was an oral outcry auction. And that's where we started it back in the 90s. And then our most recent auction was in 2022. We had 82 qualified bidders placing bids on over 8000 licenses. We ran that in a month. So we've made some huge progress and had some really incredible auction auctions along the way. But to keep innovating, we really need that authority.

John Leibovitz:
So I'll just add, first of all, just as a before I get started, I want to say that I'm speaking in this panel on behalf of myself, and my views only represent my own views on a Monday morning, which are subject to change on a Tuesday morning. But, I would say, first of all, I agree with everyone. There should be auction authority. That needs to be restored. And depoliticize also, depoliticized is one thing. I think it's just having the authority there as a baseline, kind of allows

it to just be a tool in the toolbox and not be, kind of, used or not used given people's policy predilections.

I think it just should be something that the FCC always has available when the case is there to use in an auction. I think it's important to think about what auctions are for, right? Auctions are assignments mechanisms or maybe a non assignment mechanism if you're talking about the incentive auction, the reverse auction, or the 39GHz, which had a sort of a similar flavor to it. And it can be a very, very effective one. Perhaps in many cases the most effective assignment mechanism. But I think that the utility of that mechanism for that purpose is inextricably linked with other policies that are always under discussion at the FCC, including service rules for different forms of licensing, the physics of different bands, and frankly, also exogenous things like supply and demand in the market industry structure.

So, I generally think auctions are good. I have personally participated in, I don't know, half a dozen auctions on the commission side and probably close to that as a bidder.. Um, and I think auctions are great, but I also think it's important to recognize that the auction is one component of a broader wireless policy and not the whole policy, like it's sometimes represented to be.

Umair Javed:

I can build on that a little bit. Completely agree with everything that was just said there by John. And it reminds me, I think it's important to kind of go back to the fundamentals when we're thinking about how we look at the success of the auction program, how do we think about it? And certainly the most fundamental thing ultimately is, is the spectrum that's auctioned.

Is it actually deployed? Is it used efficiently? And that was, you know, going back all the way to Coase, this idea that the benefit of the auction is that it would allow private users to internalize the costs and benefits of deploying, and it would give them that opportunity to sell it to someone who values it more. And is that system still working? I think about spectrum policy, I think it is. I joined the FCC in 2017 and then we moved into the chair's office in 2021. And by any measure, this was a really active period for FCC auctions. Right? We, starting in 2017, started holding the very first millimeter wave auctions in the United States, starting with the 28GHz band and going to 24, 37, 39, 47. Then in 2021, under Chairman Rosenworcel's leadership, we started auctioning mid-band spectrum as well. Finishing up the C-band auction that was started under Chairman Pai's leadership, moving to 3.45GHz auction and then -

Umair Javed:
Sorry, before that, also 3.5GHz, as well I should mention; so a lot of options in this period. I think since the start of these auctions, wireless carriers in this country have invested more than $160 billion to upgrade our nation's networks to new technologies like 5G. And this really represents, I think, the largest technology investment in the history of the United States. And certainly that should be considered a metric of success as well. So not only looking at the revenues that are raised in the auction, but what type of investment is coming off on the back end of it? I think when we look at it, it certainly pays off. 5G has achieved in three years what 4G did in five. So if you look worldwide, we see more than 1 billion subscribers. It's available on more than 265 commercial networks. There have been more than 2000 devices launched, 40% of which cost under $200.
You see hundreds of 5G fixed wireless access projects across the world, thousands of enterprise 5G projects deployed, and there's still a lot more activity to come. So certainly that is a metric of success as well.

Becky Tangren:
And I agree with you, Umair. The past 30 years have been very successful because almost everyone in our country who wants cell service can find it. But since we're also trying to look ahead here, we have to realize that our goals of auctioning spectrum or making spectrum available through mechanisms other than options are changing because when auctions were first started, there wasn't as much competition, and the goal really was to try and cover as many road miles as possible. But now we're seeing spectrum use on a much smaller scale, and we're seeing it used on manufacturing campuses, on educational campuses and agriculture. And the people who use that spectrum don't always have the billions of dollars it has cost recently to buy spectrum at auction. So if our goal is to keep innovating and keep putting spectrum into the hands of users, we have to keep that in mind in terms of how we're auctioning spectrum.

Becky Tangren:
You know, whether that might be with smaller license sizes, whether it may be paired with nontraditional methods of accessing spectrum through a shared licensing regime or an unlicensed, coexistence regime. And that's especially important, as we're all talking about the national spectrum strategy and talking about how commercial and federal users can share spectrum.

Sarah Oh Lam:
Yeah. So one reason why I invited each of you on is because you've been behind the scenes at the FCC for auctions and multiple. How would you go about thinking about, you know, the FCC and industry and Congress? It's a predictive exercise. No one really knows how well an auction will turn out. And also even one step before, should we even hold an auction for a certain band, like Becky said? The decision of whether a band plan should be licensed or unlicensed. Do you feel like there's been any learning or improvements in our understanding of how to do that balancing test? Do we have better valuation metrics or is it really iterative and we just learn from the past?

Sarah Oh Lam:
And one benefit is now we have 100 different auctions and we can learn from them. But is the regulator still kind of flying blind for every new auction?

Umair Javed:
Well I certainly hope we've learned and have better ability to evaluate these things. It's a hard question. Predicting technology is really hard work. And I remember, we've all heard the stories about people who predicted the desktop computer would never be a household thing. Right. And here we are. So I learned long ago not to try to predict technology. I think it's even harder to predict auctions. One example of that actually was one of my first experiences in the chair's office when we went in there. After finishing up the C-band auction, the next one we turned to was 3.45GHz.

Umair Javed:

And this was a band that went from idea to auction in record time. It had a really high reserve price because it needed to clear $15 billion just to make the federal agencies who are moving out of it. And it was an auction that started less than eight months after the record setting C-band auction that, as you noted, generated $81 billion in winning bids. So at the time there were a lot of people out there on Wall Street, in DC, elsewhere, who were predicting that this auction could fail - that it wouldn't raise the minimum $15 billion because of how much wireless carriers had just spent to get C-band spectrum. And I'll admit, reading those predictions led to a lot of sleepless nights, a lot of phone calls to Giulia and her team about what was going to happen. But we had the auction, and the auction didn't fail. In fact, as you noted, it turned out to be the third highest grossing auction in FCC history.

It raised more than $20 billion. And I think it proved that there was life in the auction program still. So one thing I've learned at least is to put the predictions to the side and just pursue good policy with clear goals in mind about what we want to accomplish when we hold these auctions.

I think in terms of how we make that decision about how to balance, um, licensed or unlicensed or shared versus other uses? I think first the United States has always benefited from pursuing a balanced spectrum policy from having all of the above approaches, recognizing that it grows the economy. I think that when I look back over the past few years, what I see is a lot of progress on unlicensed and shared bands. I think if you look in the critical mid-band range, unlicensed and shared spectrum outnumbers licensed spectrum about 4 to 1 in the millimeter wave.

That story holds true as well. I think 3 to 1 is about the estimate there. Since 2020, we've made available about 1350MHz for unlicensed and shared spectrum, much of that contiguous.

Meanwhile, we currently have no spectrum pipeline for licensed spectrum in the United States. We have no auction authority to get licensed spectrum out in the United States. So when I think about balanced spectrum policy, the place where I see the need for the most immediate action is on licensed opportunities on those full power wide area coverage opportunities. And I think that's reflected in the national spectrum strategy as well, you see that recognition both in the presidential memorandum and in the strategy itself. So I think that's where we need to focus our attention now.

Becky Tangren:
I'll just add to that I think the FCC has evolved and really tried to be more technology neutral when making spectrum available through its either, like safe harbor policies or allowing for instead of typical construction requirements, some that are more conducive to like internet of things.
And so instead of trying to predict how a band will be used, I've seen the FCC become more flexible and the hopes of allowing all sorts of technologies to use a band. I also don't want people to walk away thinking that the National spectrum strategy is endorsing that. We only need more licensed spectrum. There's likewise no pipeline for shared or unlicensed spectrum. I agree with the mayor that we need a balanced policy, but I don't want folks to walk away because the national spectrum strategy actually very much touts the value of shared and unlicensed spectrum. And we can't talk about auctions without talking about those mechanisms, too, because they're just as valid and important to ensuring a balanced spectrum policy as our options.

John Leibovitz:
I would just add a few things on that. One is that again, I think the temptation is to say there's one policy that is sort of universal and applies no matter what the circumstances. And there certainly are people, I can think of specific writers and academics, who kind of take a line on that there's always one tool for pretty much every situation.
I would say that going back to the founding, go back to Ronald Coase, if you read those papers, a lot of it is about transaction costs and about the specifics of different things: empirical specifics of different situations. One of the things I love about reading Coase is that he wasn't just a theorist. He was sort of an organizational psychologist and also he really, really, in multiple different instances, like buried himself in the minutia of the regulatory history leading up to a bunch of different decisions, whether that was the UHF TV transmission in the 50s and 60s or, later he wrote a paper in the late 60s about satellites and talked about the ITU. It was just amazing the level of depth that he went into there.
And the reason I raised that is because I think that these auctions happen in a context, and it's important to understand the context, the regulatory technical, economic, industrial context because it affects maybe how you think about the rules and the design of the auction itself, or whether or not to have an auction or whether to have something that, you know, is maybe more

flexible and encompasses multiple uses like cbrs. I think if there were no transaction costs, if we lived in a totally frictionless economy, we wouldn't really need auctions, right? We would just give the spectrum to whoever. I mean, it might be politically hard to do that, but you could give it to whoever, and it would trade to the highest and best use. Of course, we know that that is very costly. And so we have put a lot of emphasis on the initial assignment mechanism, in this case an auction, in order to try to get spectrum licenses when they are licenses in the conventional sense to the most valued valuing users at the outset.

John Leibovitz:
But I would just want to point out that typically in telecom in particular, you have these generations of technologies and ways of thinking about technology. So in the 60s and 70s, broadcast was king, right? And then in the 80s and 90s, cellular was king. How you think about what the licenses are, how the licensing should work, the power levels, the technical rules, all those things kind of reflects your mental map of the kind of current, you know, top dog technology. I think one of the interesting things that's happening in wireless is this move towards private networks, more diverse types of networks. And I think that it would be a mistake not to take account of those changes. I'm not saying to ignore the rest of the industry, which is big and important, but to take account of new developments in technologies and network architectures and things like that. When you think about auctions, right, because it changes a little bit, maybe the calculus of, well, what are the transaction costs going to be? Who? Who is going to bear them? Who? How's the secondary market going to work after the auction, etc..
And so it's complex and I think I always shy away from one size fits all type policy because things change and technology changes and the industry changes. I think one of the ways the FCC has been a leader over decades has been being at the vanguard of that change. And that's a good thing.

Giulia McHenry:
So trying to pull this all together and come up with some sort of overarching thinking from the auctions division. I think from our perspective, the idea of a focus on policy that is built on open spectrum as we need it based on the technologies today. And then that allows the auctions division and sort of the other economists at the FCC, and all those partners that we rely on, to

think about what the best auction design is to fit that problem. And that's constantly evolving. Right? And it's and it's evolving because we learn things in every auction.
But it also is evolving because as the technologies change, the problems change, right? So we've had, as we go from a world in which we're just clearing large swaths of unlicensed spectrum from the federal users to more nuanced, where we have reverse auctions and we've had reverse auctions and overlay auctions and and each of these are all essentially for us, auctions is a tool that's appropriate to repurpose spectrum or to assign spectrum for certain situations. And so from my perspective, it really is a focus on the policy, which is what we are trying to achieve. What spectrum do we need to reassign or assign in the first place? And then the auction design will follow. Right? And I think within the toolbox, the auctions division and, and all of the economists at NOAA really have, you know, at this point developed. We're at the same time that we're constantly innovating, innovating and thinking about what's the right way to auction this next thing.

Giulia McHenry:
We're also relying on everything we've learned to date. Right? So when it came to auction 108 and we knew we had all of these individual 2.5 licenses and weren't quite sure how we were going to auction them all, you know, simultaneously. And SMR wasn't going to work. We took the clock auction and turned it into a clock. One auction. So there's always some new way to think about the problem at hand, but it's constantly building on everything we've learned previously. And that I think also allowed us to do these more nuanced, complex auctions more and more effectively and efficiently. We learned a lot in the broadcast incentive auction that we apply in pieces, even just the organization of, you know, the sort of project planning and how do you move through an auction and how do you start at the policy stage and move that through as quickly as humanly possible, given the rulemaking cycles? That is, I think every auction is building on the next.
And I think there are auction solutions for all the problems that are out there today. So some of the more nuanced sharing and the dynamic spectrum sharing there are there we will, you know, identify the auction mechanisms and the right design as it becomes clearer. What exactly is it that we're trying to assign? And so I think it's, you know, they all intertwine together and evolve sort of in tandem.

Becky Tangren:
Yeah, I think that Giulia makes an excellent point, and especially as someone who worked in a licensing division. So for those who aren't familiar with FCC sort of rulemaking procedure, how we get to an auction. First, the FCC sets up a notice of proposed rulemaking. Usually if we're talking about licensed spectrum, it's coming from the Wireless Bureau, and they see comments from the public on how to use that spectrum, and then very specific licensing rules that affect then how the auctions division can go ahead and design its auction.
So before you even get to that first auction's PM, a lot of the important decisions have already been made. And that's channel sizes, the geographic size of licenses, power levels, if you have to protect incumbents, if FCC has goals of competition, which I mentioned at the outset of this discussion, because a smaller license size is likely to be more affordable to more users and thereby driving more competition on the other end of the auction. So these are all important decisions that are made earlier on in the rulemaking process. And for those who are paying attention to the auction phase, I say make sure you're paying attention from the very beginning because of all those rules that affect the auction.

Sarah Oh Lam:
Yeah, I think that's great because it leads me to my next question just about that rulemaking step. So one step earlier, from your all experience from the FCC side, do you think experts, could they be better?
And that's kind of the role of economists. Like how is it? Do you see the quality of expected value analysis and where the technology is going? Is it a high level of analysis? Or again, are people kind of predicting and guessing what value will come out of experimental new uses? I think there's a value in experimenting and trying new things. And then it just seems like no one really knows the answers. And neither does the FCC. How do you see that juncture? Maybe, John. I mean, do you have thoughts? So you were there when Sievers was kind of a new idea, early on. Like, what is the process like at the FCC and what kind of input do new advocates or proponents of a new technology have? What can they have to show for themselves?

John Leibovitz:
So I'll try to be brief. It's hard for me to be brief about CBRS. I just want to point out for the record that I led several other teams, including the AWS-3 auction, which is the second-largest auction. And I was very involved in the incentive auction. I saw that Evan is on the chat here somewhere, to his consternation, and economists everywhere, I named the incentive auction the incentive auction, which every economist hates because all auctions have incentives. But that's the beauty of the branding, in my opinion. So anyway, I think CBRS highlights a few points, one of which is that, how do you involve constituents sometimes when you're thinking about forward leaning, policy, especially technology policy, the constituents may not fully exist yet. Right? I mean, I think there's a little bit of anticipation that needs to happen in the policy process about what is possible, what might occur.
Right? Because, if you go back and look at the early record of CBRS and some of the workshops and things that we did leading up to that, we actually focused a lot on this issue of private networks. I had on my whiteboard at the FCC a little two by two matrix of, basically licensed unlicensed spectrum and wide area and local area network. We realized there was no sort of protected spectrum for local area uses. And that was something we asked a lot of questions about. And there seemed to be a lot of interest in it. And it's taken a long time as a policy process. And I think there's a lot of reasons for that, that have nothing to do with the normal course of business or even the actual merits of CBRS, but rather the change of administrations. There was a point at which essentially the rules were, were revisited and that there's a bunch of things that happened that caused the process to slow down, for better or for worse.
But, in terms of thinking where the puck going to be, part of that, was us asking some pointed questions and looking for leading, leading indicators from the community about where do we think uses in the future are going to come from and unmet needs and unmet potential, sort of latent demand that's not able to participate to Becky's point in the auction due to the license configurations, the nature of how those are done. We ran a pretty thorough process. So I was there involved in CBRS from 2010 to 2015 when I left the FCC.
I was trying to do a lot of things, I think. But one of the things that I was personally most invested in and still continue to be invested in, is a question I think you asked early on, Sarah, which is how do you know when something should be auctioned or not auctioned? Right? How do you know what the conditions are? And one of the things we were trying to get out with

CBRS is that surely that's not a binary decision. You know, that's sort of baked in the laws of nature. That spectrum band should be unlicensed or some other band should be licensed. Surely there's a continuum of conditions that can lead to one or the other outcomes being appropriate. And so the original conception of the GA tier and the priority access tier was that they were sort of parts of a yin and yang in a unified whole where the auction in part would help determine where there is scarcity, contention and high demand.

And in those places, this band will behave a little more like a traditional licensed band. And then where are there places where essentially there's no contention. Maybe your indoor inside a factory which has corrugated metal walls effectively acts like a Faraday cage or like a coaxial cable or like a mine. It's one of these environments that's essentially almost like a separate universe from the spectrum policy. And it could behave more like unlicensed. I think that's still an underappreciated aspect of CBRS and one which is not fully, you know, realized. In my mind, the holy grail of spectrum policy is to come up with a policy that can sort of mechanistically figure out that calculation in a way that takes some of the human element and arbitrariness out of it. I think there was a lot to say there. I think that in terms of how do we make CBRS more palatable, like the carriers I saw there's a question in the Q&A on that.

I just want to point out, I think it is already very palatable to the carriers. You've got one of the tier one minnows I think they mentioned at a panel I was on, they've got like 45, 50,000 base stations using the band. You've got the cable companies turning on many more base stations. Thousands and thousands of thousands of base stations and you have John Deere, you've got Dow Chemical, you've got these big-ticket fortune 500 manufacturers using the band for private networks. And you've got a lot of school districts using it to cause a digital divide. And you've got rural wisps using the band to serve customers who are otherwise off the grid. And it does a lot of things. Right? And I think that's the beauty of the band. And that's the thing that needs to be kind of protected going forward. I think there are undoubtedly ways to make it more carrier friendly, just as I think they're probably also ways to make it more industry-friendly and cable company friendly and other, you know, that it should be a constantly evolving, innovating process with a band like that.

But it's a complex ecosystem. And this is getting back to my original point, which is, I don't think there's a single set-past answer for any of these policy questions. I think you really need to

look at the conditions of the industry, the economy and the technology at the moment in time where you're making decisions.

Becky Tangren:
So I'll just quickly say in response to the question of how do we make it more palatable to nationwide carriers? Why does every single band have to be palatable to the same people? Because the majority of options are designed and licensing rules and large geographic areas. I mean, we I think we want to make sure that not only is there balance within each band, but there's holistic balance. And when you're looking at it more holistically, I think we need more opportunities of allowing all the users that John just mentioned that you all might not typically think of as spectrum users.
We need more opportunities for those folks to be able to use spectrum. And I'm sorry for whoever I cut off.

Umair Javed:
No worries at all. And actually, you know, that's an interesting point if you actually think about it. Right? We learned about this auction experience 30 years ago. This idea comes from codes. So treat it more like real property. Put market incentives around it. But the reality is, 30 years later today, we actually don't auction most of our spectrum, right? 80% of this available spectrum is still not auctioned. It's still not actually put into this construct. It's put out another way. So that's just one thought there. I have some thoughts on your question and also on everything that John was saying, and I have to say, John is one of my favorite people to talk about spectrum with, just bring such a thoughtful approach to it. I love listening to him talk about it.
First, Sarah, on your question about information and do we have the right types of information? We need to be making these licensing decisions that Becky was talking about that happen before the actual event starts, or about predicting kind of where the technology is going to go post-auction. I think the answer to that is we can be doing better in terms of the information. And this is something that I experienced, at least in the C-band context, and certainly in other bands where it felt like a lot of times, a lot of cases, the FCC just wasn't getting good information about what's really happening in spectrum bands. We weren't getting information about receiver capabilities or performance or the actual technical data that could lead to better licensing

decisions on the front end, and so that was something that we really focused on early on. Could we, could we fix that? Right? And so one of the first things we did was set up the Spectrum Coordination Initiative to start changing the way, updating the way we were.

Umair Javed:
We were coordinating with NTIA and the federal agencies, hopefully to try to get some better information. You see that theme carried through in the national spectrum strategy as well, this idea that we just need better information exchange. And I think that that will lead to better licensing decisions later. You know, John talked a lot about positioning for what might come next. And like I said earlier, that's really hard, right? It's important, but it's hard to do. I think one thing we've learned over the past 30 years is that the most important thing is that the FCC gets spectrum rights into the market quickly and completely. At the end of the day, that's what leads to innovation. That's what leads to investment. Even if all the details aren't perfectly right from the start. Get the rights into the marketplace to let the work happen. Let the private companies let the other users do what they need to do. I think that the question you have is do we get the technology predictions right? That's a mixed bag, right? One example that I always go back to is the intelligent transportation system, where all the way back in 1990, we made a prediction that eight connected cars were going to be a thing.
Let's put some spectrum aside. Let's set some spectrum aside for that. And we actually went as far to put a technology standard in there. And we said it would be dedicated short range communications. 20 or 30 years later, that technology never really took off. And it wasn't because connected cars aren't a thing, it's just because we learned different ways to do it. And so one different technology that came along with cellular vehicles to communications as a possible way to do that, another way that came along was actually not spectrum based. So you look at most self-driving cars today, they're not using connected technologies or using short range and long range radar. They're using software technology. They're using cameras on board. And so, you know, we had the right idea, but we didn't know how exactly we were going to get there. And I think the same can be said of private networks. We all know that's going to be an important thing. So, you know, industry being able to have those capabilities is going to be immensely important to the United States.

But do we know how they're going to get there? Is it going to be Wi-Fi? Is it going to be CBRS? Is it going to be network slicing, unlicensed spectrum? Germany has set aside a vertical use of spectrum to do it. They've actually set aside spectrum and said this is going to be for private networks. And so you've got all these different ways to potentially do it. And it's really hard to predict which one is going to take off. And so again, I go back to get the spectrum rights into the market. Do it quickly. Do it completely. Let the technologies develop. CBRS is one thing that it did really, really well, and this is a credit to John and his team that made this possible, by attracting more diverse participation in the FCC auction. It did that better than I think any other auction did. But there were clearly some, some pretty significant trade-offs for that as well.

Umair Javed:
One trade-off, for example, was timing. Other countries were able to make use of that 3 to 3.5 GHz band much, much faster than the United States. And they were able to do that because they could take advantage of global standardization work. They could take advantage of those economies of scale. Meanwhile, we had to develop this sort of custom solution that did take some time. And this is a consideration for the future as well. What does the upgrade path look like for the 3.5GHz spectrum? Who's going to do those upgrades. And so these are all questions I think the second trade off was certainly auction revenues, which we've talked about. The CBRS auction generated a lot less than other three gigahertz spectrum auctions, like C-band or 3.45. And this is the question mark, still is investment. Just a couple of days ago, Cmac released its report on the CBRS band.
I think one thing that it suggested was that there's underutilization compared to other auction bands in the US and compared to other countries throughout five gigahertz deployments. It notes overly restrictive modeling complex rules. That's being some of the reasons why that band is under utilized. Meanwhile, on the GA tier, it notes that users are experiencing interference that have led to outages. And certainly there's some learning, I think, to do there as well. So all of these, we can have a real conversation about what CBRS and where it was good, and what it can be used for. But we also have to recognize that it's not a one shoe fits all solution. It does have trade offs. And we do need to continue to make progress on things that also are important, like wide area coverage networks. I think in terms of how you make it more palatable goes back to where I started here.

You know, it's ultimately what matters for that wide area coverage opportunity that really brings the benefits of new technologies to all Americans. Right? The most important thing is you can put up a transmitter and you can blast that full power cover as many people as you can. Right? That's an important capability to have. And so, can you get to full power opportunities? I think to do that, you need a lot more information exchange than you do today, and you need to move past the really conservative worst case assumptions modeling that go into a lot of these bands at the front end.

John Leibovitz:
Yeah. If I could just respond really quickly just to a few things because I alluded to it earlier, I want to respond on the timeline point because I think that's not exactly accurate. I think the reason is one of the reasons why well, there's two reasons why CBRS took a while to boot up. You know, one of them was, as I said, the policy process was effectively restarted.
The band was basically ready to go in 2016, and then a new administration came in and one of the commissioners decided to revisit the rules. And they basically restarted the rulemaking on some very fundamental aspects of the rules, for better or for worse, but it happened at the instigation of CTA, by the way. So that had an effect of prolonging the whole process by several years. Secondly, it was creating an entirely new regime, basically from scratch. And if you want to be fair, you have to look at, well, people were talking about spectrum auctions in the 60s and 70s. We had oral outcry auctions, as Giulia mentioned, as the first one in the early 90s. And then it took a while for that program to kind of hit its stride, too. So I think, you know, I think we just should be a little bit, you know, ecumenical and how we talk about these things, recognize that everyone's got a perspective that they're advocating.
I would also say that I totally agree with you. You know, if you decide you're going to get rights out there, get them out there, let the market work. The point I was making about transaction costs earlier is that it really does matter if you think that utilization is not the be all, end all measure of spectrum value. We all know that if it was, broadcasting would be the highest value spectrum use. Right. It's 100% utilized 100% of the time. It's got a 100% duty cycle. You know, it's always on. It's also the highest power use, right? If you want to talk about what is a high powered use, broadcasting is high power use. You know, cellular is sort of a high power use, and most cellular networks actually don't use in most of the contentious contested dense areas where there's the

most demand don't use their full power because they've got small cells or metro cells, macro cells that are scaled down for capacity anyway.

John Leibovitz:
So it's a complex set of circumstances. When you start to talk about other very high value uses, like for example, John Deere talks about replacing thousands of miles of Ethernet cables in their factories with essentially a private cellular system, which to me seems like pretty important if we're trying to bring back jobs that have been offshored to other countries, we need to make workers way more productive. And one way to do that is to have factories that are reconfigurable, mobile on the inside and able to be much more productive to give American workers the most productivity capability that they can have that, that if if you think that that is important and potentially valuable, something that can generate a lot of economic value, you may want to think about license sizes and that are right sized to those types of operations because there's an incredible amount of transaction cost with dissecting a partial economic area. They're great for a lot of circumstances. But, you know, if you're talking about something that's several counties big, in the case of New York (it's like 40 counties big or something like that) there's some factory owner that wants to get access to the spectrum to use it. There's a lot of transaction costs associated with that. So maybe in some cases the better solution is just to grant them the rights to use the spectrum inside their own factory as a matter of right and let them trade it back to the carriers. I'm not saying that is the right answer, but I'm saying there's a set of assumptions we make in the licensing that affect the decision of how the auction works and how everything plays out downstream. And it's important to keep that bigger picture in mind.

Giulia McHenry:
So I would just. Sorry, Becky. No.

Becky Tangren:
Go ahead. Giulia.

Giulia McHenry:

Just a habit. I mean, I think I think when you're talking, I think the sort of the question is, what information does the FCC need to think about how to repurpose spectrum and assign spectrum and the best way they can? I think the answer really comes down to inputs, right? Is not having all this information and all of this, this conversation really about what are the possible uses, what uses are most valuable to the United States and to the nation, and then have the policymakers make some, you know, need to make decisions on those.

But I think at the end of the day, what the FCC needs most in order to make those decisions is the inputs. It is the information. What are the use cases we need to hear about the use cases? And I think hearing about the use cases and getting to a point where we can have a, you know, rational dialogue about the information, you know, not necessarily a worst case scenario. But actually understand how these things are being used. Then we can really dig into why we have the engineers, we have the economists. Then we can start thinking about what is right, what are the feasible uses, what's the value that may be surrounding them? I think that information as to what are the possible use cases, that's the most important piece for the FCC to figure out sort of how to auction or structure what it is we're going to auction. From our perspective, obviously, some estimate on the dollar value is important when we're getting to clearing the federal spectrum. But that is less important than what are the use cases and what is the benefit to the American public and the American economy going forward? The other thing I will note is with these long time frames, I mean, regardless of what happened with CBRS, it's a long time frame, right? All of these takes years to have this conversation between the commission and the public in terms of what these uses are. This is another. And then to start thinking about how we can clear and, you know, all of these complexities take years to work out. And a lot of that just has to do with the maturity of the spectrum and the uses that are on there now and where we may be going. All of that takes time and without auction authority, a lot of that conversation gets very stilted. And so we're halting an important piece of that conversation because as you move through that conversation, in terms of what are the uses, even before you get to the common pen, the auctions division has been working along with the Wireless Bureau for a long period of several years to think about what the right solutions are for this band and without auction authority, you know, yes, we can talk about repurposing, but the conversation, the reality is we just can't go all the way.

And that inevitably slows down the process. So this conversation is part of the reason why we need the authority in order to have that free dialogue on what the use cases are.

Sarah Oh Lam:
So my last question, to wrap up our panel, which goes into the fireside chat, which I want to encourage everyone to tune into at 4:00. Now that we've had 30 years of auctions and we're going into another ten or more, computing power was difficult early on. Like it was kind of impossible to make the license sizes really small. If it's an oral outcry auction, you kind of want a few big licenses. So what is keeping the FCC from, like what John said, auctioning off really small licenses or even having more of a grid like size of license, power level low and high. Why can't we put numbers? Why can't we go to a smaller resolution for auctions?

Giulia McHenry:
So to be clear, when we're talking about smaller resolutions, right?
When we did auction off 3.5 back in 2020, I think there were over 22,000 licenses offered, you know, ten megahertz channels, at the county level. So we are pretty good. We can get pretty granular. Right. And, there is a huge amount of computing power that we invested in to make that happen quickly. And obviously the clock auction innovation was important. So we have the capabilities to at least be auctioning at the county level. So. Yeah.

John Leibovitz:
So this is something I researched a lot a few years ago, I actually had some very interesting conversations with Paul Milgrom about it, and it would be interesting to ask him this question.I think that it's important to note there are other industries where they have extremely large scale auctions that run on a daily or in the internet, the internet advertising auctions, they've got millions and millions and millions of lots and they're running all the time.
So there's I think the actual mechanics of running a very large scale auction is not limited by, for practical purposes, by computing capacity anymore. Where it gets much more difficult is when you start to have the combinatorial aspects of people trying to piece together certain licenses, footprints. That's where millions of lots could make for a very, very, very long auction at the FCC if you try to accommodate that. I think one of the interesting questions to ask, though, is

that, you know, in the 90s, when the auctions were first getting going, you were basically turning up the first cellular networks, right? So you had network providers. This is where I get to the point about industry structure matters, right? You had an industry where there was no coverage. There were the carriers that like to talk about their layer cakes of coverage capacity and super capacity.

John Leibovitz:
There was no coverage layer, right. The capacity layer was the coverage layer. So in the early PC auctions, you had new competitors emerging that were essentially building base layer coverage and they couldn't have holes in their network. Now we're at a place where every carrier has got, you know, three, 4 or 5, six layers of to their networks. And so I think given that change in, in industry and the industry practice, it's worth asking whether the, you know, whether the relative value of contiguity and at all costs is still more valuable than having an auction that might allow for a much more diverse group of bidders. That's a real open question. And I think there may be creative ways to design auctions that solve for that, by people much smarter than me.
I love Milgrom's depreciating licenses idea. It's just a super interesting concept. I hope that comes up. But there are a lot of different ways to think about these mechanisms, that's part of the fun of it. Right, I think, is that it's not something that was designed 30 years ago that can't, you know, I know that you know, people like Evan at the FCC and Giulia and staff of really great economists at the FCC are always thinking about new ways to solve problems. But they have to do that. They have people have to ask them the question, what it imposed the problems on them. And I think that that means not taking for granted what the problem is.

Becky Tangren:
Then I'm not going to speak to the FCC's capabilities, although they have run some very impressive auctions. But I think after the auction, we have to realize technology has also changed. That enables us to use spectrum on a much smaller scale. And, for example, the spectrum access system administrators and the CBRS band.
They say we can protect any license size, large or small, and we can do it. So the technology is there. And then even within, you know, the more typical licenses, there's network slicing. There's there's all ways of managing networks. So you really can drill down to more specific use cases.

Umair Javed:
So I note that this is a conversation we had in the run up to some of our more recent auctions in C-band, for example, in 3.45, whether they do similar licenses. And could we do it? Certainly there were a lot of times when we had these discussions, some of the answers we got back was, you know, there's a time aspect to it. It might take longer to design the auction, update the software and get there. But the other piece that I thought was interesting was, you get really small or really complicated with combinatorial bidding or different packaging. There was a concern about whether bidders really had the resources to keep up and participate in those actions in the same way that some of the larger bidders could.
And so, again, it comes back to this idea of balance. And how do you, you know, where are the trade-offs as you do some of these things? I think putting aside the question of can we do smaller licenses? There's also the question of what's the policy goal and what are the trade offs. You know, John talked a lot about transactional costs and how we get the spectrum out there. Certainly the smaller the license area gets, there are transactional costs. The companies that are trying to build a nationwide service and cover large areas of the country. So again, I think pursuing a balanced spectrum policy is important. I think what we see today is that the biggest need is on spectrum that can continue to support full power, wide area uses. That's where we don't have a pipeline. That's where I think we're trailing a lot of the rest of the world in that availability and where we need to make up some, some lost ground.

Sarah Oh Lam:
Hey. Well, I think we've landed on, you know, we need a balanced policy. It's still a work in progress. More effort needs to be made to study what's out there and what's working. I think we didn't touch on a few topics, like, you know, global competition. What's the rest of the world doing? Harmonization. How does the US stand among all of that? And also satellite. So, there's a lot more to come. I just want to put in a pitch for the rest of our series. We've got four more virtual panels. Thanks, everyone for joining, and tune in for more. Thank you to our panelists for sharing their time today.