

HARVARD ELECTRICITY POLICY GROUP

WEBINAR
TUESDAY, JUNE 8, 2021

Rapporteur's Summary***Stranded Assets: This Time is Different**

Reinhart and Rogoff subtitled *This Time is Different* to describe “Eight Centuries of Financial Folly” and the durability of hope over experience. Material changes in relative market economics for long-lived assets create the problem of stranded assets. Wise investors look ahead to avoid or insure against such losses, but sophisticated investors have been surprised in the past. For energy, the regulatory compact implies symmetry under cost-based regulation, but the record presents a history of prominent challenges. Before electricity, natural gas restructuring found interstate pipelines with out-of-market take-or-pay costs estimated at the time at 40% of their book value. The FERC settlement process applied rough justice to the painful allocation between pipelines and their regulated customers. In electricity restructuring, the early days were dominated by stranded assets, and policy discussions were distorted for years by the implications for who would pay for stranded assets. Questions remain regarding short- and long-term effects. Today’s clean energy agenda is changing the mix of assets in ever more profound ways, shifting toward a more capital-intensive industry. Developers of new projects, and state politicians who favor them, argue that long-term contracts or rate-base arrangements, that shift stranded-cost risk to consumers, will mean lower costs of financing and an assurance that the projects will be constructed. How does one weigh those benefits against the risk that consumers will pay for something that long before the contract has ended is well out-of-the-money? Stranded assets that have been the focus of attention will likely grow, and it would take historic optimism to assume that new stranded assets will not appear across all sectors of the electricity system. What is being done now to deal with existing stranded assets? Will out-of-market costs become a bigger problem in the future? What is the split of responsibility between private investors and regulators representing regulated customers? Given the prominence of stranded assets in the past, are we hoping that this time is different?

Moderator.

It’s a pleasure to introduce our panel today. The topic is stranded assets. I’ve referred to this panel as Stranded Assets: New and Old, because you’re going to hear both the historical perspective on stranded assets from our first speaker, some of the hangover that exists for a lot of the fossil assets in the country from our second speaker, as well as new considerations in this time of transition and decarbonization on the new capital investments that are being made, often on long-term contracts that essentially shift the risk of stranded costs to a set of consumers,

how to arrange those differently, how to structure those procurements in a way that doesn’t necessarily put future potential stranded assets at risk.

Just briefly, Speaker 1 will define the term more extensively, but the consideration of stranded costs really used to exist purely in the context of moving regulated cost-of-service firms to competition. Here, we see new policy drivers for it like decarbonization and it is providing some really illuminating examples of the things we have to grapple with.

*HEPG sessions are off the record. The Rapporteur’s Summary captures the ideas of the session without identifying the discussants. Participant comments have been edited for clarity and readability.

I noticed, just in preparing for today's seminar, that *Energy Innovation* and *Vibrant Clean Energy* had come out with an iteration of their coal crossover report that forecasted by 2025 that 86% of coal assets would have going forward costs that exceeded the capital and operating costs of new resources.

So, the question becomes what to do with those billions of dollars that are still tied up in those assets if they're faced with retirement, either for economic policy reasons.

Obviously, it's a little ironic for me from NRG Energy to be moderating this panel. So, the answer for our company is simple: we eat that risk. But that was of course not what happens in most of the regulated utility landscape. There's a healthy debate that's happened over whether there really is a regulatory compact that requires, and to what extent the recovery of costs that are held on regulated utilities' books. There was a question to of, once you identify them or the likelihood that they will occur, what is the remedy at the accelerated depreciation before the asset finally retires? Some form of transition costs securitization status retirement. [UNINTELLIGIBLE] packages are at our disposal.

So the speakers will be presenting about really all aspects of this question: the way we've grappled with this historically, the scale and scope of potential stranded asset issues in the power sector today.

Speaker 3 is a utility practitioner trying to grapple with the question of transition and the utility of the future. And from a company, I might add, who's presented a really clear-eyed view of this problem in the context of an ordinarily sleepy depreciation study recently filed with the New York Public Service Commission.

And then, finally, we'll have Speaker 4, a regulatory practitioner, to characterize the considerations and trade-off regulators [UNINTELLIGIBLE] on this question.

So, without further ado I'm going to turn this over to Speaker 1 and then we'll cycle through our panelists without further interruption from me or questions from the audience. Then, we'll get back together on the backend.

Speaker 1.

Thank you. It's a pleasure for me to be here. I was assigned the task to do the looking back and describing some of the history and the issues that have come up in the past. Since I assigned the tasks, I can't complain about this responsibility. But I'm going to try to do a quick summary of where we've been and some of the issues that have come up.

This is one definition the Moderator mentioned there are many. Talking about stranded assets, what we mean by it, and I think it captures the critical ideas, particularly if you extend those to consider in the past, assets that sometimes, just as far as the assets are participating in the market, and we also had a lot of stranded assets that never got to the market. So that's a question that's a little bit broader interpretation, but the critical issues here have to do with the role of public policy outside of typical market forces, as I'll try to develop.

Incidentally, I selected this definition of stranded assets, because it was convenient and covered the issue, but I also love the title of the document that it came from, so you just can check there: *Shedding Light on the Governor's Failed Electric Utility Restructure*. Not a contentious piece.

The history of this issue, of course, is long and buried, and now with the transition going on in the green agenda we're going to see, I am concerned, and I expect many more similar kinds of issues coming forward in the future. The title, "This Time is Different," tries to capture some of the vibe that comes from this great book that was written by two of my colleagues at Harvard and which originally started out as six centuries of financial policy, but then became eight centuries of financial folly. The critical issue is the durability of hope over experience that somehow, we're going to not make the same mistakes going forward. We posed a number of questions here that you've seen in the description of the session, and I'm going to try to set up our conversation.

So, back then, this is an extract from a presentation that I gave that the meeting of the Harvard Electricity Policy Group in 1994. And it just sets forward what at the time we were thinking about and the kinds of assets—power plants, obviously—that were certainly uneconomic, a lot of contracts under PURPA that had been developed, which were at very high prices.

And a lot of related issues we can think of, the New York Six-Cent Law is an example of a similar kind of thing, where we legislated the prices, the prices were anticipated to be competitive with rising oil markets and all the other kinds of things, and then it turned out that the prices were very high, and these contracts were out of the money. Then a lot of other regulatory assets that accumulate over time that we saw then, and we see similar kinds of accumulations here, partly because of the subsidies and the transition we're going through now.

This, again, is from that presentation. What are the kinds of costs we're talking about associated with this other than the assets

themselves? Here, the problems are just the transition overhead costs, the meetings like this are relatively cheap, but they do occupy our time and attention. We get price distortions, because of different ways of handling these prices and the cost allocation. Lots of companies have to go through bankruptcy process, which is always very troubling and time consuming.

More importantly, it's probably more relevant today but was then relevant, is the credibility of government. Where we stand up and we say this is our long-term policy for the far future. You should be making long-term capital investments, based on the theory that we're going to stick to it—and then they don't stick to it.

The most important one, which is a reason I put this slide up all together, is the last one, on transition cooperation. I highlighted what I consider to be the key sentence, which actually comes from this earlier presentation, which is "managers at many companies are mesmerized by stranded distributed asset problems."

When we were discussing this back then, I used to say that if you went to a meeting and you thought you are talking about energy markets or policy related to the electricity sector or anything like that, you were probably mistaken. You were going to a meeting where they were going to talk about trends stranded assets, because everything that everybody was saying was strategic. Because they were worried about how they could affect the transition and how it would affect their stranded assets. We had to get past that stage, so that we could actually have productive discussions about all the other issues.

The overview, then, is, again, if you don't do something with it, you're going to

compromise the transition, you're going to lose some of the efficiency of a quick transition. There are lots of ways in order to deal with this, so it doesn't have to preclude doing what we want to do in markets. But we need to do so in a way that's consistent and the key idea is, which is the last way, which is, ultimately, unless you're going to use the tax system, which is a kind of a similar version of a monopoly segment, you're going to have to collect through some monopoly activity, by which we meant, essentially, wires services, which are the remaining monopolies that we anticipated, And that's what happens. We have the recovery of the cost of the California energy crisis was done through wires charges, in effect, even through complicated securitization mechanisms.

Some of this was done through long-term contracts of the wires business with generation and the contracts were set at prices that people thought were going to be remunerative and it would be a simple transaction after the fact, because the prices would go down for the customers once we finished paying off the stranded assets. But the actual contracts turned out to be actually very attractive because other prices had gone up and, then, when you quit contracts came to an end, we had a problem. They didn't want to raise prices in the market, they were getting below market prices at that time. So a lot of complications that came out through those kinds of processes. But basically, the monopoly idea is the critical one if you're going to collect money that people don't want to pay.

This started all, of course, before electricity, we had natural gas restructuring and we used to regulate prices of natural gas in the country. That's an interesting story in itself, but with the Natural Gas Policy Act we started the process of changing these, but we

did it in a very complicated way. There are lots of different categories: old gas, new gas, deep gas, and so on, at all kinds of different prices.

In the process of getting rid of those things we had, essentially, a lot of take-or-pay contracts that had been signed, and the system then was the pipelines would purchase gas in the producing region. They would take title and then they would sell the gas to customers in the consuming regions. Along the way they were the contractual owner of the gas and they signed up a lot of contracts that were take-or-pay contracts. They turned out to be at high prices. Now what are they going to do?

And what the pipeline started to do was to create something called special marketing programs. What "special" meant was, we're going to charge relatively competitive and low prices for customers that have choices. And for customers who don't have choices, you're going to pay for that deep old gas. Their prices are a lot higher.

This was very contentious. The Maryland People's Councils case, which I was involved in, was the critical thing which led to the elimination of these discriminatory programs. Then that created this legacy of contracts and stranded assets that could not be sustained. And we went through all the FERC orders to open up the gas pipeline industry to get to the more competitive market.

The money transaction and the debate at the time was very contentious and very unhappy, I have to say. This is an old chart which just showed what the estimates were at the time about the amount of essentially stranded cost. These are the take-or-pay costs that are above market for these companies, and you can see the eventual allocation, some of it pipelines

and some of it to in-use customers. It was orchestrated by FERC and basically it was all voluntary. FERC said, "This is our proposal, and if you accept it, we will approve it. If you don't accept it, we'll see you in court." All the pipelines lined up that accepted this proposal.

Related and going on at all this time, were the other problems related to nuclear power. Three Mile Island, we're familiar with. People tend to forget about WPPSS, the Washington Public Power Supply System, whose acronym was pronounced whoop. They actually had to go bankrupt because their nuclear plants had turned out to be too expensive and they were not competitive and couldn't complete them.

And the thing that was interesting to me at the time was it was the largest municipal bond default in US history up to that day. I suppose it's not true anymore, but it certainly was true then. Seabrook, we're familiar with and Public Service in New Hampshire filed for bankruptcy after the courts barred them from passing along its cost to customers. And, of course, the Shoreham Plant, which never actually went into operation, spent over \$6 million install cost and produced no electricity. There was a complicated deal, it was worked out with the prior governor Cuomo and the Long Island Electric Company, which basically parsed this out and had a wires charge, essentially to collect the money, mostly from customers.

I'll remind you that not all the turmoil that we experienced produced what I'm calling stranded assets. The key distinction here is the one that the Moderator made about the symmetry of risks and rewards and the regulatory complex and impacts of public policy. Here's just an example I quoted from the *L.A. Times* in 2005 with Calpine Corporation, which lost a lot of money and eventually went into bankruptcy proceedings

and so forth. The way I interpret this and describe it as summarized there, Calpine adopted a business strategy to enjoy higher rewards if successful and face the cost if the market turned out to be different than expected.

This is quite different to the situation where public policy poses a symmetric risk. And this is the case the Moderator was talking about, with his company, which is where they're not regulated assets and so, if there's a problem, it's the company's problem. Then, if it turns out they're tremendously valuable, it's the company's benefit. There's symmetry.

The surprises that we saw continue. I've used this chart with us before. On the left, there is another example of somebody thought it was really going to be a good idea, and it turned out not to be such a good idea, so that was a *bad* surprise. On the right is the shale miracle, which was a *good* surprise, at least from my perspective. We didn't anticipate we were going to have this enormous success in shale that had all kinds of knock-on effects.

I think this is a very important fact which is going to dominate what's going on here. I referred to it here as "guaranteed surprised," an interesting phrase I stole from an op-ed in the *New York Times*. The basic idea of it was something's going to happen and, if you have a strategy for the future which depends on knowing what's going to happen, then you're in trouble. That's the simple reality test that we have to face.

The current problem, the problem that motivated this whole conversation, was this the growth of subsidies that are going place. Here's a summary of the impact of that in terms of carbon policy from Bill Nordhaus.

The great line that came from Joe Bowring in PJM in the bottom about subsidies are

contagious. Competition in the market could be replaced by competition to receive subsidies. I think there's a lot of that going on right now.

It's especially problematic in the context of this green agenda because many of the new technologies, certainly renewables, have been even more capital intensive than the things that they're replacing. We often think of nuclear and coal as being capital intensive, which they are, but at least they have some variable costs and it's not all just capital and continuing maintenance. I think, the sort of leveraging problem is actually getting worse here for the future going forward.

In the discussion we had back in 1994, we listed out a series of strategies, ranging from do nothing—Cold Turkey, tough, there is no recovery—the delay which many people were pushing in order to work off some of the problems. But mostly it turns out to be surcharges on the wires business, which I think is a practical method for dealing with the recovery that we're going to establish.

My summary at the time, is just to show that we were trying to think about what to do about developing a better understanding of the kinds of costs and how we're going to be doing it and how to treat these different markets differently and trying to get the transition strategy going and having better methods for recovering all of those costs. I hope what we're going to learn from today is how the problems that we're seeing today, and in the near future, are different than what we've seen in the past and how the strategy might be somewhat different. One thing I hope we don't make the mistake of saying is we don't have to worry about this problem. Because I think the historical evidence is just thoroughly compelling. It's going to be a big deal.

Thank you.

Moderator: So, we'll turn it over now to Speaker 2.

Speaker 2.

Thanks. So, my job is to take a look at the future of these stranded assets. The way I decided to take a look at it just doing a thought experiment: if we are taking a look at our current asset base of fossil fuel infrastructure, how big is our stranded assets problem or how big could it be if we take a look at one of the more aggressive potential outcomes?

Let's say we do actually pass the Biden administration goal for an 80% by 2030 clean electricity, and then something like 80% by 2040 or 80% by 2050 for economy-wide decarbonization. We have a lot of major infrastructure with unrecovered costs today. If we make no more investments after today in these resources, we have, let's say, about \$800 billion of resources. These are not all stranded assets, of course, because many of them will recover their costs before they go out of service. But many of them are stranded assets today already.

So, the question is, if you actually believe that we will achieve that kind of clean energy future—something in that time frame—what fraction of these are going to be treated as stranded assets? Who has to pay for that? And then, what should we do about it, if anything?

I just wanted to walk through: how does this look for different pieces of this? So, just starting at the top, first is a whole bunch of assets out there, that I didn't really put on this figure: fossil fuel extraction—there's a whole bunch of cars out there that maybe we'll end up having to do Cash for Clunkers to retire these early.

I didn't really try to quantify all of that. But I think the one of the things that we are seeing or will see is that companies that really have that future are going to have to reposition themselves.

Of course, I think probably a lot of us are really following the Engine No. 1 story in terms of Exxon Mobil or Exxon's board take-over and the Engine No. 1 investment fund. First, not being taken very seriously. They made a \$50 million investment in stock. But, at the end of the day, they made a really strong business case that you have to be positioned for clean energy transition. That's why the likes of Black Rock and CalPERS made votes to change that board. We see that, of course, across many players in our industry as well, on the electricity side. In any case, it's turning into good business or smart business to change your portfolio of investments.

Next down, oil and gas pipelines. We have a lot of folks who do quite a bit of work with pipeline owners and shippers, so I was peppering them with questions about what's the endgame here. Let's say we have this scenario where we have lost 80% of our shipping volumes in oil and gas pipelines. Of course, it's hard for folks to envision that these days. You can easily repurpose some of these for the export market or the like.

But what is the endgame there for these resources? Actually, the investors probably are going to end up bearing that cost, most likely, if they become stranded assets. There is some precedence of what happens or what's likely to happen as shipping volumes decline and contracts roll off. Then you have to try to get new contracts and renegotiate higher rates or if you're heading up to a rate cap, you probably have to argue for a higher maximum rate.

But, at the end of the day, there is a point at which even in a natural monopoly sort of infrastructure, the market won't bear that cost. If you're down to 20% volumes, the shippers are just not going to be able to bear that sort of a cost, the entire cost of the pipeline, just to run 20% volumes. So, there is a point at which these pipelines are going to be decommissioned or shut down and sharing the cost at least for a time period with some of the shippers, but eventually back to the investors in order to be pipelines.

Gas distribution, of course, has a strong utility compact. The gas distribution systems are built under a regulated cost recovery model and the ratepayers are going to notionally pay that cost. But, to me, this is one of the areas that really needs a lot of new thinking. The current approaches, the historical approaches, are not going to work if we really follow through on these 80-by-'40, 80-by-'50 decarbonization goals.

I think, just to put a pretty fine point on it again, if you get down to 20% of your sales volume, the first order of math is that you're just putting rates up by 5X on the last remaining customers. That is not sustainable, especially since there's a really good chance those last customers are going to be low-income customers that are really not in the best position to make investments in electrification and the like. So, we really need a different policy framework to tackle this problem. I'm actually really interested to hear what Speakers 3 and 4 will have to say about that.

Then, finally, the generation assets. Regulated assets, we kind of know where that's going. I mean, we are in the middle of that with coal plants, especially with how we're going to deal with stranded assets on that front for the coal plants.

On the merchant side, as the Moderator said, the investors are going to have to eat the cost. That puts us in a very awkward position, and I will say what Speaker 1 mentioned about, I forgot how he put it, but that you show up to a lot of meetings and it's quite obvious that we are talking about a stranded-asset problem throughout a lot of these discussions that we're having.

I don't want to dwell on this too much, because I think I made some of the points that I wanted to make, simply there are places that are really taking the first crack at thinking about how to rework rates, how to rework the investment model, how to rework the business model of utilities in a place where we're really talking about massive, rapid electrification and decarbonization. But, at the end of the day, we also need to make sure that we have a way to pay for this, and hopefully manage prudence on that.

When we're talking about putting in a lot of capital down to make some of these investments, it really would be good to find ways to do that that are cost effective and have that discipline. But when it's so rapid, of course, this is going to be a huge challenge.

OK, moving on to the regulated fleet. First of all, 40% of the coal fleet is already on the books to retire. We already have a massive stranded-asset problem today with coal plants. The order of magnitude number that I put was, let's say, about \$100 hundred billion. Some of that's merchant, some of that's regulated.

In the regulated space, how this is getting treated is interesting. For the most part we see that traditional ratemaking approaches are just going to continue to be used. There's this acknowledgement that if the investment was prudent at the time of investment that we're

going to just continue with regulated cost recovery.

But there are other places, a lot of folks are talking about securitization. There's several examples of it, in terms of basically taking that off the utilities' rate base and funding it through special purpose entities. I think we're going to see probably a lot more of that, especially as the very big dollars at play through some of these investments make it kind of untenable. Some of these traditional purchases are optically challenging. Not that many so far are subject to disallowance or partial disallowance. Because, again at the end of the day, there's the utility compact: the promise that customers are going to pay for this if it turns out well or poorly.

Then, on the merchant side, we have, of course, many of these similar assets, but they've been forced into retirement. So, if you see the trends of the retrofit versus retire decision of coal plants in some of the merchant markets versus in regulated and regulated contexts, it was really challenging for a lot of the private investors to make the case that they could actually make a go of it after some of these very major capital investments, where there are some utilities that are now put in a position of having made major retrofit and reinvestment investments to environmental controls for assets that are now no longer cost effective on a going-forward basis.

And then, what happens when gas plants start coming into this question of stranded assets? There are a lot of gas plants, obviously. This is the majority of our capacity of the largest source of supply in our resource mix today. A lot of them were invested in in 2000 and have a lot of investments over recent years. Really cost effective. They look like the most attractive investment for a lot of utilities and merchant markets both. We see this

investment happening, both in emerging markets and in regulated-utility contexts. When we talk about 80% clean electricity by 2030, these assets look like they're in a lot of trouble.

OK, this one, if I was more on the ball, I would have done an audience poll, so if anybody actually does respond to my question, I'd love to see it in the chat.

What happened with the last PJM capacity auction results from last week? If you weren't hitting refresh that day the way I was, the capacity auction—much, much awaited, we waited several years for this. It cleared \$50 a megawatt that day. Really low prices here, 95 in some of the eastern parts of the system. Compared to the new investment cost of the gas CC—PJM's administrative number, it just depends on what location you're looking at—but that low could be quite a bit higher.

And, of course, the number that people have in mind is much higher than this in terms of their expectations about capacity prices. At the same time, we saw 5600 megawatts of new gas plants built. This is such an interesting kind of conundrum. I think, depending on where you sit in the industry, this can look a lot of different ways.

For one, I think my first reaction was, well, how in the world are these folks making money? They must be losing money on day one. They must have made an investment, two years ago, when the supply demand conditions look tighter. Now, they can't go back on it, so they clear anyway, even though they never could have made a go at \$50.

Then the other thing is, that just puts a pretty strong point on the overarching context of how people are looking at not just the PJM market, but all of the wholesale power markets. Is this a sign that the market is

working? The market is attracting \$5 billion in one year of new investment from private capital, both putting their money at risk to deliver very, very low-cost capacity. That's the market working for one angle. But, from another angle, for the states that really want to see rapid decarbonization for customers that want clean energy, this is just throwing good money after bad. We're seeing continued investment in fossil plants, when we need that capital invested in clean energy.

So, is that a standard asset problem waiting to happen? Of course, on the books of investors and maybe not on the books of customers. Or maybe the investors are right, and folks are going to backtrack on the policy goals.

One more thought on this. One thing I do see as absolutely essential, a next step for the wholesale markets to address and prevent some of these problems and better align is to match the demand of the market. We have customers and we have policymakers that want to go green, and I think recognizing that and letting them express that demand in the marketplace, finding a way to do that through the marketplace, is really a critical element in the next phase of wholesale market design. So that we don't end up in a situation where the policymakers and customers are forced to do something drastic to avoid paying for fossil plants that they actually didn't want in the first place. If they want to pay for green energy and use markets to do it, I think we should give them that solution.

I'm really optimistic, really excited about the next phase of discussions that we're having in New England and in the PJM region about how to get there. I think we have carbon pricing as one tool or pathway to get at least part of the way there. The forward clean energy markets or integrated clean capacity markets that we've been working on are another tool to get there. But at the end of the

day, these all serve the same purpose, which is to allow customers to express their demand. not just for energy, but for green energy in these markets, and shift the investment signal, so that the supply is meeting that demand.

A couple of thoughts or takeaways. First of all, if I think about this from the investor perspective, broadly, putting capital at risk. I think you have to be ready for this. Whether you think it's happening slowly or quickly, being prepared and well positioned for that kind of green economy of the future that's happening. Pace is really critical. So, maybe not putting yourself in the position of having only assets that are at risk to be become stranded.

Then, policymaking around stranded assets. I think there's no good solution to stranded assets. Somebody has to eat this cost. And it's a matter of who eats the cost, for the most part. But there's at least one thing that is definitely the case, which is you don't want to keep spending and keep spending more money to retain assets that are no longer cost effective. If a coal plant's fuel costs and operating costs exceeds the cost of brand new wind, let's find a way to enable that retirement and make sure that we're avoiding economic waste.

Then, the other thing, I think I dwelled on this a little bit, but if we're really talking about in the LDCs, the distribution companies' systems, if we're really talking about achieving the 80-by-'50 goals or 80-by-'40 goals, we have to rethink how we're going to address the distribution system costs. We're talking about public safety here. We need to have some amount of going-forward investments. But how can we limit the going-forward costs and resources that we know are going to become, essentially, stranded assets? Then, how are we going to share that energy

burden equitably? There are lot of folks that could be hit by this, they're really not in a position to pay. So we are going to have to carefully think about that.

And then, on the next phase of market design, I do want to say, I think that we're going to have a lot of opportunity here to show the ability of markets to bring in that private investment to meet the challenge of that kind of clean energy transition. We have a lot of investment needed. I think, demonstrated by what the markets have already done to date, through private investment signals, we can do that on the green side, too. But we just need to make that transition.

Moderator: Thank you. We'll turn to Speaker 3.

Speaker 3.

Great. Good afternoon. Anyway, a lot to follow up on what Speaker 2 covered. I'm going to give a higher-level perspective on where New York is now, and specifically ConEd's role in gearing up for the clean energy transition.

Just as background, New York directed the utilities, like in a lot of the northeast states, to divest its generation back in the late 1990s. To some extent, that prepared us really well for embracing clean energy, because a lot of the investments are displacing or competing against some of the traditional fossil investments. So, the ability to invest in energy efficiency and reduce our sales, the ability to invest in clean energy or encourage our customers and help our customers invest in clean energy is easier if we're a delivery company.

So, we were heading down that path. When Audrey Zibelman took over the chair of the commission, along with Richard Kauffman, who is the New York energy czar, also head

of NYISO and New York's secretary of energy, and embarked on this Reforming the Energy Vision, they basically indicated that the traditional utility model of investing in capital and earning return on it was not the right tool for the going-forward, competitive distributed energy markets that they envisioned, where customers would be more empowered. There were a series of orders that laid out the framework that we're now working in.

The first was rules of the road from the track one portion of REV, which basically said while this new distribution market is being set up, utilities are a facilitator of it. We can build out the distribution system platform that will enable distributed resources to communicate and coordinate and incentivize them, but we should not be a direct owner of distributed resources. That's the role for the competitive market.

This builds on the divestiture of generation view that New York had. That was one of the foundational things. There are a few exceptions to that—if there's a market that's not working, assets that are directly connected into our distribution system—the rules of the road going forward were clear that we were not going to be active investors in this distributed energy market, or at least the resources that would be customer sited.

The second tenet of REV was really on the rate design and how does the money flow. We were strongly encouraged to look for alternatives to traditional investment in utilizing these distributed resources. The balancing act, to say that if we're not going to be investing in that space, we really need some other upside opportunities to make sure we had the right teams working on these issues.

That led to this concept of non-wires solutions, where we would effectively pay resources or a portfolio of resources to provide targeted load relief to avoid investing in substations or transformers or feeders. That kind of concept led to the ability to treat a lot of what historically had been pass-through investments—some of our energy efficiency programs and demand response programs were effectively a pass through—to convert them into a regulatory asset, where we could actually amortize them over typically a 10-year period and earn a return on that.

That was, while not dollar for dollar, was supposed to create an offset. So, if the expectation is we're investing less than traditional CapEx, this was the upside. Then, overlaid on that was the state's, at that time, pretty lofty renewable goals. Then, under the CLCPA Act, it really got amped up and became really significant. Whether the governor was trying to keep pace with and outdo the other governors or was truly embracing the environmental goals or recognized that New York needs to decarbonize, whatever the motivation was, the CLCPA goals that New York adopted are significant and, one could say, daunting.

The key is to focus on what is achievable and the five-to-10-year timeframe, recognizing that we will either need new technology or some new tools to get to the 2040 and 2050 segments of the decarbonization goals. What is interesting is, when we embarked on this distributed market, there are a lot of people that procrastinated or proposed that the distributed electric market was going to go into a spiral downwards, because customers would invest in renewables, energy storage, microgrids, and effectively isolate from the grid.

That proved not to be the case, because the value of a lot of those resources was often exporting and sharing some of their surplus with other customers. Effectively, there was an implicit use of the distribution grid to allow for the efficient investment in those resources. So, we're seeing a lot of two-way flow on our distribution system.

But the real message is, to get to these broader renewable goals we need a new set of assets. We need a significant amount of renewables delivered into our load centers, which historically were generation pockets—which means new offshore wind interconnections, new transmission to bring more upstate renewables in, and new energy storage.

On the next slide is the first real effort that we did on Con Edison's part. We issued an RFP in 2019 to solicit 300 megawatts of bulk storage. For a variety of reasons—economic, for one thing, as well as some COVID issues that challenged a second project—we were only able to execute one contract in this first solicitation.

But in this regulatory asset structure, even though we, as ConEd, are not owning the asset, we are the catalyst for getting these large clean resources up and running. So we entered into a seven-year contract with 174 Power Global to build a 400-megawatt-hour energy storage system on in the blue area on what was the old Poletti Power Plant.

For those of you that know a little bit of New York history, that was a power plant that ConEd actually started building in the '70s, sold along with Indian Point 3 to the New York Power Authority, and then the New York Power Authority agreed to dismantle it when they built a new combined cycle plant a little further north on that property. So, this brownfield site was really an ideal location,

sort of a three-way partnership of NYPA being the landlord, 174 developing it, and Con Edison entering into a scheduling contract for seven years to firm up the revenues to allow the operator to achieve financing. Presumably, in 2029, after the seven-year period is done, 174 Power Global will continue to operate.

I would premise that, at least on the electric side, these clean energy goals are creating a lot of alternative investments. So, while energy storage and other clean energy may make it challenging economically for the Astoria Power Plant, which is right next to this battery facility, to operate in the future, these new investments and New York's approach to this regulatory asset and the utility acting as a catalyst, are probably a good opportunity for the regulated electric business.

Here's another example of a creative solution. While we're not allowed to own batteries, we took a parcel of land that's reserved for a potential future substation and we're making it available to third parties to build a smaller battery. The site should be able to handle about 10 megawatts of batteries, along with electric vehicle charging. So, the ultimate decarbonization of a broader segment. The batteries will help with balancing the power grid and some of the intermittence, and the EV charging will hopefully be the catalyst to help decarbonize the transportation sector.

Where this is all going is going to be, significant changes, this was the results of an EPRI study on New York state as a whole. On the left side you see the four main sources of electricity use. The bottom one, vehicle charging, is *de minimis*, for want of a better word. The red shows a little bit of electric-related heating. The blue shows a lot of cooling. And then the gray is baseline non-seasonal, on a statewide basis. This even

includes some industrial loads upstate. In 2050, EPRI said, absent significant incentives, we should see an uptick in EVs, but we're not going to see anything really transformational. But if you overlay the steps that are likely needed to get to the New York CLCPA goal, a significant uptick of heat pumps could very well make New York a winter-peaking utility.

This assumes existing air source heat pumps, with some electric resistive backup for the coldest days, which could effectively double or triple New York's electric load and make us into a winter-peaking utility. Current forecasts are probably in a 2040 timeframe, we're going to criss cross and become winter peaking.

So, what does that mean? Certainly, opportunities for the electric side, but some challenges for our gas and steam business. Once again, we're still working through with a lot of people on what that means. There were a lot of customers with buildings that were designed around gas and steam service, so I don't envision closing off the pipes and abandoning them and making their building effectively a stranded asset.

I see a lot of pressure to try to find ways to decarbonize what thermal energy we push through those pipes, whether that is harnessing as much renewable natural gas. At some point, if hydrogen electrolysis becomes cost effective, some of the excess renewables in the shoulder period could be used to make hydrogen and other aggressive end uses to help customers reduce their energy use.

That's my read of the tea leaves, and I look forward to discussing more of how this all fits in when we get to the broader discussion session.

Moderator: Thank you. I'm always happy to be your neighbor at the Astoria site, even if you don't have dispatch rights for our facility.

The next speaker has the unique position of being able to comment on what everyone else has said, but I know you have some really good thoughts of your own on the subject.

Speaker 4.

Thank you for having me. This has been awesome. I think I'm really just going to repeat a lot of what we've heard in the first three speakers, but this is really great.

Something big has just recently happened in Rhode Island to change the threat landscape for utilities. I just want to take a minute, as I get started, to talk about the nature of risk as the outcome of threat vulnerability and exposure.

Gas utilities have been vulnerable to the threat of climate regulations for decades, because they sell a carbon-intensive product and they're exposed, because they own billions of dollars of infrastructure that's hard to liquidate. The electric distribution company, at least in Rhode Island, is not as vulnerable, because it can deliver low-carbon electricity just as easily as fossil-generating power.

But we're talking today because the threat of carbon regulation has gone from possible to certain and that has created a certain stranded asset risk.

Until recently, climate and energy policy in Rhode Island was guided by aspirational greenhouse gas reduction goals in a variety of executive orders and reports from the energy office. But, in April, the legislature passed the Act on Climate, which is a requirement for greenhouse gas reductions that makes it clear that it will no longer be safe to sell

carbon-intensive fuel in Rhode Island by 2050.

While it's always been clear that gas companies were exposed and vulnerable to carbon policies, because we had wishy-washy policy in Rhode Island it wasn't clear how real the threat was. Now, Rhode Island is unambiguous that there is a threat, and as a regulator, now I can assign the stranded asset risk of fossil-fuel-based utility investments.

I don't know if the legislature or the utilities are thinking about it in the same way. But to me, now that it's so clear that this risk exists, regulators need to determine who will bear the risk of losses, and if we don't deal with it now the stranded asset risk is going to get bigger.

So, what I want to talk about on the next slide is that, in order to minimize the stranded asset risk, the entity that can manage the risk needs to be the one exposed to it.

Normally, as Speaker 2 pointed out, the market assigns investment risk. But in the case of utilities, the regulator needs to do it. When I'm assigning risk, I'm not doing it just to stick it to someone. It really matters for outcomes. Ratepayers should share in the cost and risk that can't be avoided in order to provide the utility services they're expecting, and the utility should be exposed to the remaining risk.

It helps me to consider a distributed generation interconnection as an example. In that case, there are three parties that could bear risk: the ratepayers, developers, and the utility. So, to the extent that distributed generation benefits ratepayers by improving the distribution system, ratepayers should be allocated that cost and risk.

But net benefits will vary across the system, because interconnection can be more difficult and more expensive in some locations, and ratepayers can't do anything about that. They can't decide where to site projects to be most beneficial. We expose developers to these variances by assigning location-based interconnection costs to them, to the developers.

In other words, to the extent that developers cause the cost of upgrading the distribution system, they should be exposed to those costs. And we hold the utility accountable to timely interconnection, because that's what the market would do.

But if developers weren't exposed to that price signal, we'd end up with low value deployment in the forms of systems that are not optimally efficient, because they're more expensive or lower yield than the marginal generator on the system should be.

Another example is electric vehicle fast charging. In Rhode Island, the electric utility has a pre-approval of interconnection costs. And there's a demand charge holiday for the charging station, the charging customer. So, no one has an incentive to strategically locate a fast charger or invest in storage to minimize the cost of system upgrades that would be needed to handle the demand from that charger.

This is probably okay for now. It's just a pilot. It's limited to less than half a dozen charging stations or so. But if that were to continue at scale, we'll build a grid that's more costly than it needs to be.

And the key point that I want to make here is that it matters that the entity that can manage risk is the one exposed to it and we'll get different outcomes depending on how we manage how we allocate risk. If the entity

that can manage the risk isn't accountable to it, investment in the system will be higher than necessary in there for the stranded asset risk will be higher than necessary.

And the stakes here are really high, as Speaker 3 just pointed out in his last slide. The stakes are so high, because we're counting on the electrification of heating and transportation to combat climate change. If we make the power system more expensive than it needs to be and send counterproductive price signals to consumers, we'll risk not meeting our climate goals.

Electrification has the potential to hand over a huge market share to utilities, but it will only be sustainable if we get there because utilities show that they can serve new load efficiently. That means that utilities have to be disciplined enough to forego short-term opportunities for risk-free growth or they're going to price out their own product.

So, Rhode Island's new Act on Climate law puts a little over a billion dollars in gas assets at risk of becoming obsolete in the next few decades. The gas company is the only entity that can minimize those losses. They're the only ones that can source gas from cleaner resources, present customers with alternatives, or make sure that their equipment can deliver other no- or low-carbon products.

Basically, the utility is the only one with any control over the usability of its network. But this is also a company that's become accustomed to operating with very little risk. When gas assets go into the ground, they're going in with pre-approval of their gas capital spending. Until this year, the gas company was getting cost recovery on its assets before the assets were even used and useful. For example, just this spring, the gas company

asked for pre-approval of spending on two studies for potential infrastructure projects that might never get built.

On the electric side, the electric company is so risk averse that they won't invest in electrification that stands to grow their business. Utilities' reason for existing for the last 120 years has been to sell electricity. But the utility won't even take on the risk of growth for electrification. Instead, they're only interested in risk-free growth from pre-approval of interconnection costs, ratepayer-funded fuels, rebates, ratepayer-funded advertising in similar approvals. So, this is a company that isn't used to even taking on normal capital investment risk that they stand to benefit from.

It's not clear to me that the legislature, or the utility, is fully aware of the potential loss that's on the table now. But they should be, because it's huge and we need to start working quickly to minimize it.

I see the regulator's job right now is to gradually turn up the long-term stranded assets risk signal. Because, as I said, there's a lot of money at stake and the utility needs to know that it stands to lose if it doesn't come up with a plan for minimizing losses.

But this is not going to be easy. The utility and its stakeholders are used to solving difficult issues by shifting risk to ratepayers. Here's a recent example. When, in 2018, the commission, and I served on the commission at the time, our commission granted pre-approved funding in base rates for a suite of grid modernization investments, because we were getting asked by stakeholders to approve funding for what they called a bunch of foundational investments in order to get the ball rolling on grid modernization.

The utility didn't want to make the investment, because they didn't see what they described as a burning platform. They didn't see that it was a compelling risk to them, of not transforming. But we heard from stakeholders that the utility needed to modernize in order to meet state clean energy goals. The utility explained to us that they were able to interconnect all of the distributed generation that we wanted into their existing system without these investments and that, if they were going to invest in grid modernization, they were only really doing it to meet the goals and desires of the stakeholders. The stakeholders got the utility on board in the settlement by shifting the investment risk on to ratepayers.

So, two years into that multi-year rate plan, which would have been last summer, the utility reported that they weren't making those grid modernization investments. They're on track to collect around \$25 million from ratepayers in what should be going to grid modernization investments.

But, as of last summer, very, very little spending had happened, and they were only projecting to spend a fraction of it by the end of the multi-year plan. They were pocketing the rest or spending it on other things.

Now, we're a notice of a sale. National Grid is selling their companies in Rhode Island. And it isn't clear that we're going to be able to hold the utility accountable in the future. Ratepayers are out their money, and they don't have any of the grid functionalities or benefits that they thought that they were buying.

The key point from this example, or from the story, is that we can't pay the utility for things that they aren't accountable to.

I came away from this experience with at least two connected lessons. The first is that when utilities take on investment risk themselves, they take those investments seriously. It means that the company executives have been convinced that the investment is necessary to running their core business and it's worth it for the company to take on the risk that they won't get cost recovery for it.

The second lesson is that, if it is necessary for ratepayers to take on investment risk because of the nature or the characteristics of the investment, the project, or the losses, stakeholders need to be very clear about their expectations and make sure that their settlement or their plan holds the utility accountable to delivering those functionalities. Because if the utility isn't doing something to meet the objectives of their own business, they're going to have a hard time meeting the objectives of somebody else.

A lesson related to that grid modernization story is that sometimes governments take on risk when no one else can handle the potential losses. And sometimes ratepayers do take on risk of pilots or, like I said in the story, to get an obstructionist utility out of the way.

But the transition from when it's appropriate for ratepayers to take on risk to when it's inappropriate is a matter of scale. What I'm afraid is that stakeholders aren't necessarily shifting their position when it's time to scale up. And if we continue to de-risk the utility, the stranded asset risk is going to keep growing.

We need to think about how to treat existing assets, as Speaker 2 had a great slide on. For sure, we need to change our approach to new infrastructure. We can't keep giving the utility pre-approval and pre-review and no

accountability, and then suddenly flip the switch in 2050 and hold their shareholders accountable for billions of dollars in obsolete assets. Nor would I want to dump this all on ratepayers.

As regulators, we're standing in for the market and we're responsible for making sure that both sides are exposed to the appropriate risk. So, we need to gradually start holding the utility accountable and making sure it understands that it's been assigned this role of minimizing losses.

I just want to end by saying that there are lots of things that the utility can be disinterested in. They can be disinterested in whether Americans buy a lot of electric vehicles or whether Rhode Island enters long-term contracts for offshore wind or whether the Transportation Climate Initiative goes forward.

But the utility has to have a stake in serving load as efficiently as possible, because they're the only ones that can do it and they can't walk away from it. If they don't have a stake, they'll have no reason to do a good job and that matters for outcomes.

So, my conclusion is that the utility can't be a disinterested party in transforming the utility network. And now that everyone stands to lose billions of dollars, the exposure to that loss should be particularly motivating to the conservative, risk-averse utilities that we regulate, and it should also be motivating to regulators and ratepayer advocates to help minimize their total losses.

Moderator: Thank you very much. I think we've represented a really broad range of perspectives on the part of our panelists, and I think it's been informative and thought provoking. We are going to take a 15-minute break. You'll have the option of joining a

breakout room or you can go get a cup of coffee or do whatever you like.

Discussion.

Moderator: We're going to give the panelists a bite at the apple first to respond.

Question #1: This is a question for which I don't know the answer. So, it's not a setup here. I'm just trying to find out how to think about this problem. I was keyed off by the statement that the regulator is supposed to stand in as the replacement for the market in areas where we don't have markets. We have this regulated system. That's a familiar idea and one that I find appealing.

And then, the other side of the story, I at least would say is the subtext of the presentation is, we have to meet these goals for carbon emission reduction—that's just a given—and our job as regulators is to have policies so that we drive towards meeting these goals.

I would say that markets don't think that. So, I think we have a tension there. If I were in a market that I was making advancements, I would say these calls look pretty expensive when you start getting farther out. When you get up to 80% removal of carbon, the marginal cost is getting higher and higher and there's some chance they we'll just decide, "No, we're not going to go that far, because it isn't going to happen."

And then the other threat is the international community, where, particularly in developing nations, you see that these costs would be even more problematic, and they're not going to do it. Then, you ask yourself, "Why are we doing this globally, going well beyond what we have argued is the social cost of carbon?"

If I were in a market and making investments, I would be weighing both of these

alternatives, one where we do get there, and one where we don't get to the target emission reductions, and then trying to think about my investments and weighing those probabilities.

That seems to be very different than what the regulators are doing. So, we don't have the regulator standing in front of the markets. I don't know how to resolve this problem because—well, I don't know what to do. Help.

Respondent 1: I apologize if you misunderstood me. Regulators don't make policy. In fact, what we do is we recognize state law. What I was trying to say is, until recently, as a regulator, the risk of stranded assets was hypothetical. Like you're saying, it was up to other non-regulatory entities within the market to assess the risk, the threat, as they chose and for the utility, if you do that themselves.

But, as a regulator, we had no certainty of a stranded assets risk. What we have now in Rhode Island is a law that defines and identifies that there will be a stranded asset risk because now there's a binding climate regulation. Now, as a regulator, I can apply that law and consider it in our decision-making, where we couldn't do that before. Is that clarified?

Questioner: I think it clarifies that we're not communicating. If I'm NRG and I was investing in these markets and I say, "What about this law in Rhode Island?" And then say, "Well, there's a good chance little changed. It's changed in the past. It could change again in the future." I don't want to make a lot of investments on the assumption that this law is the last law to be passed to this domain. And I want to do something completely different and that seems to be a

fundamental inconsistency here between regulation and markets.

Respondent 1: Certainly, you can't guarantee certainty forever. But, as a regulator, I can assess the prudence of an investment, based on what was known and knowable at the time that the utility made that investment.

That is why I think investments that the gas company was making up until April, would probably be treated one way versus if they come in there seeking to make investments today. We're going to be looking at them differently. If the law is [UNINTELLIGIBLE], we would be referencing back to the point, what was known and knowable at the time that the company is making that investment.

Moderator: I think that makes sense. Do other panelists have any comments?

Respondent 2: I think one of the one of the topics that came up in our breakout group was, was this not known and knowable at all 20 or 30 or 40 years ago, that there was the potential for this. I think I got challenged. I think it's a good question.

Is there just a solid premise that actually utilities are 100% protected from this risk, even though actually many of us have known for a long time and the market also knew that there are these risks.

Moderator: One of the interesting things, that's sort of sticking with existing assets or assets that are being contemporaneously invested in that have sort of fossilized attributes and potential change in law risk, it's interesting to me how in different regulated industries, we have different conventional wisdoms on the same question.

Because, obviously, for a long-time telecom existed in the same sort of regulatory theory, regulatory spaces, as regulated energy industries. Yet, when competition occurred and the infrastructure of the local exchange carriers seemed to be technologically obsolete, it was not the case that there was guaranteed recovery, even though regulators had done a lot of regulation and pre-approval relative to the Ilex plant and service. The conclusion was, to borrow Speaker 1's term, cold turkey: "Sorry that you as a regulated utility invested in all this copper. We'll give you some recovery based on its going forward value to people interconnecting to it, but we're not going to pay you book value, certainly not a return on stranded book value."

And, yet, the conventional wisdom for the regulated energy space certainly seems to be that companies will at least be made whole on their net book balance. Probably, as I think Speaker 2, you demonstrated in a slide—some studies pulled by Metin—that a regulatory asset will be created to allow them to earn both a return of and a return on undepreciated plant balance.

I just observe the conventional wisdom that applies to the regulated energy system and embodied in the kind of folklore of the regulatory compact that's cited so often that it's become a meme, if you follow Ari Peskoe's Twitter handle, is simply not the conventional wisdom of some other regulated industries.

I honestly don't know why that is. I'd love to hear perspectives if people have any. But I'm going to let that hang there for the moment.

Question #2: Thanks. I had an interesting conversation that's related to the session. It's a question to all the panelists.

All the panelists focused primarily on investments in, let's call it fossil-related infrastructure that have been made. And then questioning whether, in a world that decarbonizes for whatever reason, those things then become stranded. How do we deal with those stranded assets?

If Speaker 2 is right, and that's a little less than a trillion dollars' worth that's potentially at risk—probably much less actually addressed by the time you take off things that have some value. That's probably much less than the amount of money that needs to be invested going forward to actually get to that decarbonized system down the road.

One of the interesting questions that I thought would come up and that I've discussed is, in creating mechanisms for making those investments in decarbonized energy systems possible going forward, are we creating risks for creating new stranded assets? If so, is there something on the other side? So, that's a cost. Is there a benefit? And the benefit that is articulated is we were offering in several of the states' long-term PPAs that provide revenue certainty. That makes investing in these projects less risky. Therefore, the cost to ratepayers is lower in the first place than it would be if you expose the project developers to the risks of that related to uncertain market conditions.

Shouldn't we also pay attention to the risks of stranding assets for all this new investment that's necessary in how we design the mechanism through which we attract this investment? If so, is it appropriate to at least think empirically about the two sides of this? Someone pointed out in the breakout room that secular stagnation is with us. We're in a world where there is a fair amount of excess capital that's chasing yields around the world. So, the point was maybe you don't need 20 years. If you offer them something that's less

than 20 years, you wouldn't see an increase in risk. But, given all the excess capital that's out there looking for investments, you might not see a big increase.

So that's the kind of tension I'm curious what the panelists think about, whether we should think about that carefully going forward. Thanks.

Respondent 1: If you don't mind, I'll hop in. Great thought.

As a New York utility, we remember very well some of the financial challenges from the old Six-Cent Law that Speaker 1 referred to in his talk, and clearly do not want to replicate the traditional long-term PPA.

From our perspective, if you want to go down that route and truly de-risk a developer's investment, you should consider utility ownership of the asset, because then at least the utility on behalf of the ratepayers have some residual value. But, putting that issue aside, which is very contentious, what we're doing with our bulk storage solicitation, we're entering into what I'd call it medium-term contracts. The first round was seven years. We're going to do 10 years now.

Recognizing that the merchant revenues are not yet predictable enough for people to invest in large energy storage on their own, we're trying to provide a bridge to help demonstrate the market revenues, whether it's regulation, whether it's energy arbitrage, whether we will find enough off-peak energy or bottled-in renewables, so that these storage devices can effectively, work with renewable generators to help get them to market and capture renewable energy credits that would otherwise be stranded.

So, I think there's a lot of potential that isn't yet proven. But by entering into mid-term

contracts, I view it as a very long period of training wheels, but we will eventually take off the training wheels and let the merchant model, hopefully, develop and flourish. That's my hope of a transitional mechanism to get some of these new, relatively capital-intensive assets looking at energy storage and—we're, arguably, on behalf of all ratepayers, New York's doing it through NYISO. Other states are doing it through the utilities entering into long-term contracts with offshore wind developers to de-risk their investment on behalf of our customers, because we know we need those assets to get to the longer-term environmental goals.

Respondent 2: Of course, every time anyone's making a decision to invest, that's always creating a risk of stranded assets. You mentioned PPAs, and we already in Rhode Island are tens of millions of dollars underwater every year in our Deepwater Wind, the Block Island wind farm. I don't know that that's a stranded asset, but it's certainly like an unfunded liability, it's above market every year. But I guess what I see from where I am is that a lot of these decisions are being made in a political economy by legislators and administrations who are not just looking at climate and how to reduce carbon. They're trying to achieve a whole host of other goals—economic development and jobs and ribbon cuttings along with all of these investments, which certainly increases the stranded asset risk of all of those investments, and which are impossible for us as regulators to deal with.

Those are all stranded-asset externalities that are happening outside of the power system, but which ratepayers are on the hook for paying. There's not a lot that we can do other than trying to hold the utility accountable to them, but the utility can't be held accountable to things that they have no control over.

Moderator: Maybe I'll ask the other panelists to chime in on this, because I know our company has been concerned that the market design of the future, as we pivot to clean energy, is just people going around with a begging bowl asking for 25-year contracts. That doesn't seem like a very healthy outcome and there's been work on good market-based off-ramp that still respects the need for financeability of new entry of some emergent technologies as they get the training wheels off.

Respondent 3: I'd love to see that next phase of market design look at how do we attract private capital competitive into achieving the states' policy goals. The integrated clean capacity market that we've been working with the New Jersey Board of Public Utilities to develop as an option for the PJM region for clean energy market is another kind of variation of this concept. The point there being if states want to go, 2030-40-50, 100% clean electricity, they could specify that and then let the market decide what resources are going to come to bear. Who can do it at the lowest cost? In that case, actually, we don't have a stranded asset problem, because what happens is, just like they have in the merchant markets to date, the private investors can sink their capital into this market, find the least-cost approach. If they see a ton of risk of policy U-turn, they might price that in. That's true.

But maybe they actually come up with something really innovative. Maybe they come up with really low-cost solutions. Maybe they don't work themselves into a corner like places like Ontario have, where they actually built the wrong assets and then they're on the hook for 10 terawatt hours a year of clean energy that's getting spilled or curtailed. In that case, if a private investor did that, they'd bear the risk of that on economic choice, not customers.

I think that a path forward in the merchant markets really is kind of taking that concept that we've actually seen work well, the competitive markets to attract that private capital, and then try to target that investment toward meeting the state policy goals. I think there was a great point that some of these policies that are legislated that, maybe, are all that amenable to this sort of a concept. If it's very localized or it's really hard to match that policy through the market. But there are also a lot that really are amenable to that, if you're just talking about you know 50, 75% clean energy, I think that's a pretty clear constraint that the market can build to.

Moderator: Thanks. We've got two hands up. Let's go to the first. Please continue raising your hands or you can ask questions in the chat.

Question #3: Hi, everybody. First of all, to your comment about stranded assets—and there are a few people who go back as far as I do in this group—I think this stranded assets thing took off with nuclear and we need to understand that the nuclear stranded assets got created very fast.

One day, there was this thing called Three Mile Island, and for the next many months, the regulations changed and changed and changed. And with those changes, the costs went up and up and up, like triple was not nothing new. And they changed the regulations in the middle of them retrofitting, and so they'd rip out stuff and put it back in. That is a very different thing than scientists beginning to say, at least 30 years ago, it came into the political discussion that there was this thing called climate change and that we needed to start thinking about how to control carbon and other climate-related emissions. They're very different animals. That's my first comment.

My second comment is, how stranded is an asset that is fully depreciated or should be fully depreciated? I'm thinking of things like transmission lines that all of a sudden are getting rebuilt in certain regions of the country, and their asset values are going back up and it's not even clear we need those specific transmission lines.

I think that, fundamentally, this idea that we're supposed to use regulation to insulate customers for risk is an obsolete idea. Just like a lot of the technology we're talking about is obsolete technology, there is no insuring consumers from risk. We face technology risk going forward, as well as policy risk. A lot of this is being driven by technology change, as it was in telecom, and I think we have to reformulate the compact, regulatory-wise, and start talking about, we cannot insulate you from risk. We can mitigate risk. We can do what financiers do when they project finance. We can't get rid of the risk. We can manage the risk, and I think we have to start all over again and think about all of this in different terms.

When these original compacts were formulated, technology didn't change that fast, we had a digital world in electricity for 100 years or more. Now we face change all the time. What Ontario did got overturned by technology. Whatever we do with the next round of zero carbon emissions, technology is going to be overcome by technology. If we're going to call these things stranded assets, we're going to always have them.

If you accept my premise, what are some of the ways we can move forward in a paradigm that matches the world we're in? I also mentioned in the breakout group, it would be very nice with all this technology risk and utility customers are automatically investors, because without them, you could never get

the debt, you could never finance the technology. How could they get upside risk when they're making these investments?

Moderator: Anyone? Good observations.

I guess I would offer I'm consistently not speaking to transmission assets, but, on the coal assets, I'm consistently surprised how much remaining book investment there is on some of these things.

I was just looking at some small midwestern utility that owns a little smaller than a 200-megawatt plant, had like \$115 million remaining in net planned investment for a coal asset that was built decades ago, clearly reinvested in, probably, with environmental controls over time. They were arguing before their regulator, they basically did their IRP and said it's actually economic to remove this plant from service, but you should still allow us to have a regulatory asset, with a return of and our weighted average cost of capital applied to \$114 million, or whatever, that we still have tied up in this facility because it's an important part of—here's that word again—regulatory compact that you not punish us for making economic decisions. I have a view of that, which I won't characterize for you here, but those are the kind of asks that would be made in there.

Someone just commented in the chat that environmental controls are still driving along those costs. I've just been surprised at the dollar figures.

Question #4: There's a big difference, of course, between what happened in the '90s and what's happened today. My own personal view is what happened in the '90s was consumers paying a huge bribe to a lot of utilities to go away and shut up while we change the world.

What's going on now is much more of a policy-driven thing, but there's still certain common denominators that I think are important. Number one is whatever returns the owners of the assets that are being threatened at the moment, what were those returns for? What risks were they taking? It wasn't like these were not-for-profits that didn't stand to gain from those investments.

So, what exactly were they earning returns for? And how did the investors look at that? If Wall Street was able to respond and invest in those things—it's not like climate change is a new concept. I can remember during the acid rain debate, people were talking about climate change. Obviously, the debate stepped up and scientists have known about it for a long time. The question is, these investments were made, people are calculating the returns, what risks did they take in mind? And, in fact, if those were internalized, and smart investors internalize most risks, is there really something that consumers should have to pay for that aren't already compensated for in the existing returns?

And the second question, that relates to the knowledge of climate change, is, when these investments made? If they were made 50 years ago, scientists knew about climate change, it wasn't new to them, but that wasn't widespread. But if they were made in the last decade or the last 15 years, and you didn't know about climate change, whose problem is that?

So, when we think about this question, are we too quick to be looking at giving stranded asset recovery? When you go back and when I looked at the '90s, and what we did, we spent a huge amount of money on paying off companies that for the most part, this is not directly, but there's a large proportion

between how efficiently they were run and how much stranded assets they recovered.

And the question is, are we running that same risk today? That's for anybody on the panel. It's not directed at the utility representative on the panel.

Respondent 1: I'll take a stab since Con Ed doesn't own much, if any, generation. To some extent, I think it's a good point: when were the investment is made and, coupled with that, what was the assumed depreciation of that extra investment?

If you're putting money into a 40-year-old coal plant and saying that CapEx I'm now going to put another 40 years on that new CapEx onto an old plant, there's clearly a mismatch of expectations. But where I see the pressure on a lot of these plants is not necessarily from a regulatory perspective, but it'll be an economic perspective.

You were seeing it effectively with the shale gas putting pressure on coal and nuclear units' revenues, basically forcing a lot of nuclear units to seek additional compensation in a number of different state proceedings because they were, effectively, out of the money and needed some extra support and a recognition that we needed that carbon-free electricity to still continue.

Where I see the future of some of these older plants is, economically, whether they're investor-owned through the utility or merchant-based through at-risk capital, the economic pressure should lead to retirement decisions and actually that can create an opportunity because those sites and those interconnection locations could be great, whether it's energy storage or offshore wind. There are probably a number of aging New York plants that ConEd used to own and we divested, that could be good candidates for

offshore wind interconnection points in the future.

So, there's always a phoenix that can rise up out of the ashes and create value, or at least create a new value. It may not be dollar for dollar but create a new opportunity for some of those sites.

Moderator: Or you can turn your old power plant into condominiums. There's that, too.

Respondent 1: Waterfront property, right?

Moderator: Did any other panelists want to get in on that?

Respondent 2: I think there's a good point there and I think it's partly an answer or a type of answer for the challenge to have a different coal framework.

To simplify it for my own mind here, if you say we're going to have a depreciation schedule for recovering from ratepayers to assume that this plant is going to last for 40 years, that's a statement up front and when we follow that and then if it turns out something bad happens after 20 years, you have a stranded asset. If you think that, no, we can't do that because we can only look out about 10 years, we don't know what's going on, then you could have a depreciation schedule that was 10 years. That would be an example of a new way to think about the problem to be consistent with what was asked about, and it would also fit in the description of what the regulator can do and what it can't do.

Moderator: I do know that there have been some cases both in RMR litigation where there's been new capital reinvestment needs to keep a facility online and then some gas LDC reinvestment in places that have gas bands for residential and commercial use, where the utilities have promoted the idea of

a very abbreviated depreciation lifespan for the new CapEx.

Perhaps not a particular surprise that some of the very people who have generally been aligned with public policies that restrict those assets continue to use, nevertheless also oppose accelerated depreciation. So, it is something, though, that I agree people need to think through. I give credit to Con Ed. It commissioned a really interesting report that considers these alternatives that I've linked to earlier in the chat, if you scroll up. It will automatically download a PDF it doesn't seem to work very well in Chrome, but if you use Microsoft Edge, it seems to work, and I assure you it's not malware. Done it on my own company device, everyone.

Question #5: Thanks, everyone. Very interesting session. I appreciated the questions, because, as I heard all the discussions initially go through, I was a little surprised that most of the discussion was backward-looking at the existing stranded costs—which I'm not saying it isn't a big issue. But, again, it feels like it's an occasional issue which hopefully won't get in the way of moving forward.

Some of the issues that were teed up around how do we get moving forward in terms of the investment that's needed without recreating the same sort of problem, and one of the things I've been thinking about it and trying to figure out how to get more flexibility in the contracts that are going out for the new "clean energy."

And particularly noticing that if you look at the contracts that are entered into by the Googles and Facebooks of the world, where they can come in, and, of course, the context in which they are entering into these contracts are much more flexible, they are not worrying about an entire system, etc, etc.

But, if you look at the contracts over time, those have started longer term, about 20 years, but the overtime has been diminishing. I see that as basically someone coming to the market with some flexibility and discretion about what they're entering into, but they know they need the product. And counterparties' suppliers being willing to enter into those more flexible terms.

It seems we often get, from a regulatory standpoint, the regulator trying to recreate that market, get ourselves in the box where typically for standardization we need to set that term length, whether it be through a state-run PPA or whether it be through a forward capacity market. New England, up until recently, had a seven-year low price lock in for new entry but recently got rid of that. To my mind, when I look at this, I'm interested in people's views as whether or not we're best off starting with creating the real spot market for clean energy, if that's what we want.

This is setting aside, believe me, if we can do carbon pricing that'd be great. But setting aside the political problems with carbon pricing, there's a lot of discussion now about enhanced RPS clean energy standards, etc. Why don't we get the spot market for that product set up right first? There's talk about a forward clean energy market, seven-year lock-ins.

The same way we were on energy markets and have, basically, get the spot market setup and then let forward contracting work, maybe a day-ahead market, maybe the forward clean energy market works in that context. But focus more on getting that spot market price.

Would these things eventually solve themselves? I know many participants go, "Wait a minute. The reality is banks won't

finance it anymore, we need that counterparty to back the debt, to give you the hedge multi-year." It feels like we're in this chicken-and-egg problem where, under certain circumstances, the market participants and suppliers will meet those terms. But it's hard to get the market moving.

A related question in my mind is, from a policy standpoint, is there actually a value in locking in some of that price? As in, there's a benefit from both the buyer and a seller side to locking in and fixing prices of buyers and sellers want to hedge their prices. So, why isn't some kind of locking in that's beneficial to both sides? I realize from a policy standpoint, it becomes very hard for the government or the regulators to determine that on the consumer side. That seems to be a fundamental challenge with that premise.

But let me stop there, because this is a dilemma, doing work now that's kind of very immersed in this set of issues, but it seems to me that we're struggling to get the market to basically provide flexibility over these terms in a way that we can ratchet down the requirements over time and get out of basically locking ourselves into 20-year PPAs for the next 30-40 years.

Moderator: Would anyone on the panel like to address this?

Respondent 1: I definitely liked a lot of this question. Like I said, I think we do need a lot of these ideas on the table, whether it's a forward clean energy market or a spot market for this product. I actually think we should try to get any and all of the above.

I guess just getting back to some of the concepts around what a better spot market for clean energy looks like, I do think there's just a lot of innovative potential out there as to what can the product look like. I think one of

the things that I'm really interested in is, can we define a better REC. Can we define a REC that's really built around carbon abatement? Not necessarily just all RECs being equal, but rather with the carbon value of that.

I think if you go to that point in terms of defining a better REC and create a better spot market, I think that will be really interesting. I think that could certainly form the basis of a lot of innovative contracts and then maybe that turns into the opportunity for policymakers to take it forward and use that product for procurement or the like or even as the basis of contracts. I think that's really interesting.

I think the other thing we're dealing with is, as was mentioned, we're in a political economy here, too. The path forward is not just about what's actually the best economic solution. I think we can take a poll, and I think a lot of folks would think we want to see a really strong carbon price that is reflective of policy value. Maybe we can't get there, though, because we are in a political economy. We do have to consider the fact that we have a lot of different states, they have a lot of different policies already on the books that do need to be met. They're law.

There are a lot of states that have literally no interest in spending money, not even a single dollar, to deal with the carbon problems. So, I think it is worth trying to see where we can get that innovation. I like a lot of what was just said in terms of having the opportunity to move on better product design and better spot markets. Maybe if we have a better REC people will start buying it.

But, at the same time, I also think we really need to just get one of these in play. Because if we don't, I think the markets are no longer going to serve their purpose.

Moderator: Next.

Respondent 2: I think that's right. That is the issue—states' markets can, and they must, internalize carbon externalities, the carbon externalities from power generation. But they can't internalize the impact of state procurements that are realized outside the power system. In other words, there's always going to be reasons that states are going to want to contract for resources that have nothing to do with the power system.

But these markets operate, as was said, inside this political economy. And they need to acknowledge these resources that states have procured by allowing them to liquidate any capacity value that their contracts have in their market. States' contracts for clean energy and capacity are hedges, and states should certainly own the above-market cost savings from those hedges. But they should be allowed to liquidate the market value and barriers to liquidating that make that contract, I guess, less liquid.

Moderator: One of the interesting trends I've noticed in some state RPS policies recently: a demand by the part of states that to qualify for particular treatment under the RPS, say, a retailer who wants to self-supply or for one of our large CNI customers, is the demand for additionality. You may end up in a situation, I'm concerned, where because you don't have a uniform product in terms of a REC or a clean energy credit being traded and you have just this consistent demand for additionality, that you may end up in a place where merchant renewable projects in year 15 don't appear to have a lot of value to people, even when they continue providing clean energy to the system.

Hopefully that problem will resolve itself but it's certainly something that we've recently noticed, creating two classes of renewable

citizenship, in addition to all the other fragmentation that happens in terms of renewables and clean energy.

Next question.

Question #6: Thanks. This has been a really well-done panel, and I want to thank HEPG and all the panelists for the great insights. But I think that what we're seeing a lot of with the stranded assets, we're dealing with a lot of the fallacy of the future is going to look a lot like the past.

So, some of the things that were going on with respect to pollution controls and some of the back and forth in the chat that was brought up about the amount of steam plant service, most of those are the pollution controls. But let me ask the panelists, in terms of stranded assets in the current paradigm, how much of this is related to overly optimistic load forecasts in the RTOs?

And, whether it's in PJM with RPM or in ISO New England, with respect to the forward capacity market or anyplace else, how much of that is creating a sense of stranded assets? I also have in mind with respect to the Panda lawsuit against ERCOT, when the loads had come in lower than what the load forecast was saying: "Well, we invested based on information that was not true." Obviously, forecasts are never going to be correct, but if we look historically those forecasts have been biased upwards on a pretty consistent basis over the last decade and a half, maybe two decades. So that's the first question.

The second one is in part of the conversation some of us had in the break. The issue was policy risk, and not just policy risk, but also technology risk I'll put in there. So, you have known unknowns, not to be Rumsfeldian here. We know that gas prices can go up or down, weather can change, you can have a

hot year, an unusually cold year, and so on. We understand what those look like, and we can probably assign probabilities. But it's the unknown unknowns that are problematic. So, when investments were made in pollution controls for coal units, shale gas wasn't in anybody's radar. Now, all of a sudden technology took off.

There's the mercury and air toxic standards. People can claim that that was something that we didn't know was going to happen. I think there was probably fair warning over time, but there are certain policy issues there. So, that's the second unknown unknown that creates the set of stranded assets.

The other one is the lack of policy direction. While states are trying to pick up the mantle, I think, historically, the industry has looked toward the federal government and federal policy, whether it's FERC or DOE, with respect to certain reliability issues, or it's EPA. That's been sorely lacking for the past, say, decade and a half here, since the mercury and air toxic standards.

Where do we go from there? How do we address those unknowns and all the stranded costs that investors have made? This is just the cost of the risk of doing business and they have to eat it? Or should we find some way to once again, "bribe" the private sector with public sector money to make it all go away?

So, curious to hear some perspectives on this.

Moderator: Go ahead.

Respondent 1: The way I think about this is buying time and buying the opportunity to have alternatives. Both of those things will minimize the risk of stranded assets. By setting policy, the deadline becomes more certain but the alternatives that are going to be available are not known at the time.

By setting far-term goals, the lack of having a firm goal at some point in the future, the deadline becomes less known. There's more uncertainty around the timeframe, but there's more time for alternatives, or maybe more alternatives to be available to solving things with.

I think that those are the two key levers how a legislature or regulators are looking at the climate transition. Are we setting near-term goals and having fewer alternatives available to us, but having that certainty that we know what to do? Are we setting distant goals, less certainty around a deadline, but more optionality with what kinds of alternatives might become available?

Moderator: Any other panelists? A reminder, if you've got a question or a comment just put your hand up. I see some good contributions in the chat, but if you want to elaborate on any of those happy, we'll take them.

Questioner: If there's no other panelists, I want to ask a follow up. You're speaking my language, almost thinking about this as a real option—waiting for better information before pulling the trigger on certain decisions that are potentially irreversible and could result in some stranded assets that are now sunk.

In the political economy that was talked about, how do we do that? Because politicians often want to be seen as taking action rather than waiting to take action? I happen to agree wholeheartedly with what you're saying, but from a political economy perspective, how does that message get through to legislators and other regulatory bodies to have that patience and to not take action when there seems to be a political imperative to look like you're acting?

Respondent 1: I don't know how to answer that. I see it all the time. It happens all the time. I don't know what the solution is.

Here's a very small example we were talking in the breakout room, about EV charging infrastructure. I think that there's lots of different ways to solve range anxiety when it comes to electric vehicle charging. I personally own an electric minivan that also has a backup gas tank. That's how I've solved range anxiety. I've never used a public charging station in years of driving an electric vehicle.

But what I see is that there is political pressure to want to have ratepayers invest in massive amounts of charging infrastructure in visible places on the street. That seems like a giant risk of a stranded asset, and those are funds that could be invested in other sort of solutions to range anxiety.

As a regulator, what I'm looking for when the utility is coming in with a proposal to have ratepayers fund these kinds of investments are a really solid case for value, need, and accountability.

I think the best that we can do is making sure we get the best out of each of those cases. If there is a lot of politics driving the desire to have the ratepayers fund these investments, how do we make sure that the utility is going to be held accountable in some way to delivering on benefits? For example, making sure that they're at least strategically locating these charging stations where they're going to be used rather than sitting vacant most of the time.

I think that the example is very far removed from, maybe, where you started, like wholesale power level. But I don't know how to solve it, it happens all the time now.

Questioner: I think the example is a good one, even though it's not the wholesale level, but it's a great example. I appreciate the thoughtfulness and the response and the example, as well.

Moderator: Thank you. Let's go to the next question.

Question #7: Thanks. I had a question that could really be for any of the panelists. As we talked, a couple of previous commenters noted that the profile of stranded asset risk is a bit changing going forward.

In particular, I wanted to zero in on the experience with renewables investment and how that risk management lesson learned is starting to manifest itself. Someone had an interesting point in the chat here that I thought I'd bring up, too, where we've only seen for the last couple of years, certain models of renewables procurement going forward. Typically, these are all just independent developers, and you'd have PPAs, etc., and be done with it.

But what we're starting to see is the great switch has gone off on green rate base, and we only have really maybe a couple years of really demonstrable evidence to see how risk is being managed under different regulatory paradigms. I'd just be curious from the speakers or anyone else who wants to chime in, if I'm allowed, what some of the early data points are telling us about how that risk paradigm, in particular, affects risk management in that asset class.

Moderator: Who would like to opine? Or if there's an attendee who wants to take that who's in renewable development or some other space, feel free to chime in.

Respondent 1: I'll share at least the visible New York experiences that a lot of the

early—this is land-based wind developers working on a fixed-priced, renewable energy contract and taking merchant risk for the physical power. They were effectively in the same boat as coal and nuclear units that, when the shale gas changed the market dynamics and some of the capacity market reforms really suppressed what little capacity revenue they were getting, many of them went into restructuring.

The machines were still going forward, virtually little to no operating costs, they're still running, but the original investors no longer had an equity position after the going forward cash was unable to support their debt obligations, either because they didn't have long enough hedges on it, or they were effectively exposed to market volatility. As a result of that, at least New York has embraced this form of an indexed REC, which gives them something close to a fixed price. Whether it's right or not, it takes out some of that volatility.

So, I think that the lessons that everybody should have learned from when the original combined cycle overbuilt, that you can overshoot. The market will be different than you assume. If you don't hedge, you're exposed to it, and there's investor risk associated with that. And whether those investors are de facto ratepayers because the utility is making those investments or whether they're independent investors in merchant plants, I think it's the same dynamic.

With the declines in, certainly, solar right now that's once again adding some new pressure on, whether it's the restructured wind contracts or other contracts that, as the original, whether it's SREC hedges are rolling off or some of the original structure PPAs in California, some of the renewable developers could see challenges in the future as some of

those hedges roll off. It doesn't mean that the assets are bad, it just means, depending on how they've structured, their anticipated financing and their debt service, there could be some squeezes down the road. I think that's just healthy for the industry, people who were prudent will do well, people who were more optimistic may be in for a surprise.

Moderator: I'll just add from the perspective of us as a buyer of renewables, we've contracted for, at this point, about 2200 megawatts over the last handful of years, with an average 10 or 12 to 13 years on the contract. So, consistent with what other people have said, we've seen in a more competitive market contract line code down and developers being willing to tolerate that more.

Then, one other feature worth noting, it's just the curtailment or basis differential risk. We've seen a greater willingness of renewable developers and financiers to take that risk, at least in the context of the market that we work in—that experience is not uniform—and some people who have entered into contracts on more of a smaller ad hoc basis are very interested in sleeving that risk into a larger retailer or generators portfolio.

Anyone else?

Respondent 2: We have an experience in the last couple years. Our state has contracted for offshore wind a couple of times now. There are still the same three entities in that triangle. There's the project developer, the ratepayer, and the utility. In the most recent contract that we reviewed for Revolution Wind, the developer is taking on all of the construction risk of the project—making sure it's built, that it's going to meet its timeframes, it's going to deliver the energy. Ratepayers are taking on all the market risk of the energy and

REC products. And the utility is the billing agent, essentially.

Our commission found that they're taking on no risk. I feel like this is supported by utility testimony, that they can't influence the ultimate value of that contract to ratepayers. Once the contract is inked, they can walk away from it. There's nothing they can do to influence the eventual above- or below-market price of the contract and the cost or benefits to customers.

But the utility is the one who's still asking for remuneration for these contracts. So, in Revolution Wind, they were asking for about \$80 million in remuneration for the contract, even though, I would say there is no risk no risk to them. We rejected that request. Not everyone agreed with that decision.

Moderator: I have noticed recently in the annals of utilities being billing agents or pass-through agents for renewable PPAs a marked growth in the assertion that there should be some kind of margin for them on it. It's interesting where those lines are broken down. I mean, sometimes the independent developers logroll it into success. They figure, well, the only way we can carve out an independent model for our business is by giving a little gravy to the utility. Most places seemingly have held firm on that, but there are some notable exceptions.

Question #8: At the risk of this disintegrating into a conversation towards the last half hour, I want to make two comments loosely related to changing contract structures over time.

For some of these technologies—it goes back to the point about the first offshore wind project and PPA. There are some half-dependency there, where it's at least conceivable that the slightly riskier contract structures are possible today because of other

contract structures leading to initial projects earlier. In some sense, if you think about a new technology like offshore wind, it's almost certain that the first project entering would almost certainly be stranded shortly thereafter. Because the fact that an entrant provides so much learning that cannot be appropriated by the initial developer that, basically, destroys your own market that way.

So, that was one. I think we ought to keep in mind some kind of sequencing where the early projects are more expensive in terms of the contract than later contracts. Then, maybe ultimately, the contracting structure can change once the developing community and the financing community is more comfortable with where the technology is compared to the competition, the substitute. That's one point.

And the other point I was going to make is, the real option story is appealing. If there's a lot of uncertainty out there, waiting is good. But, of course, that's assuming waiting is free. When we adopt that kind of approach, we should at least think about whether or not there are costs to waiting—I suppose, somebody could have come up with a much cheaper COVID vaccine if we just had waited another couple of years.

And, so, one could argue that the world massively overspent in vaccine development. But I suspect very few would claim that that's a stranded cost that wasn't worthwhile incurring.

In the discussion we're having now, it depends on whether or not investing rapidly now has some cumulative benefits on, say, greenhouse gas emissions that are worth enough that they might justify not having waited, but making some decisions now that may *ex poste* turned out to be not so prudent

or stranded. So those are the two comments, maybe somebody has responses to them.

Moderator: We have a response.

Respondent 1: My response is “You’re welcome!”

Moderator: Is guinea pig the state animal of Rhode Island?

Respondent 1: It's not a joke. I think, as I mentioned in my initial remarks is that, yes, sometimes government takes on the risk when the losses are too big for anyone to handle except for government.

I’m a native of Rhode Island. I have a hard reaction to feeling like Rhode Island is the best position to take on all of that risk for the benefit of everybody else on offshore wind.

Moderator: It has been a remarkable feature of the New England conversation, to the extent that I follow it recently. Connecticut regulators say, “Why do we have to be the ones to pay for our nuclear plant?” And you hear from others saying, “Why do we have to be the ones pay for this offshore wind?”

That all seems to come back to the point where there should be some kind of regional market with more of a uniform product definition that does a better job at allocating the costs of clean energy to at least five out of the six states who seem to be demanding it without regard for particular technological specification.

Obviously, you could go to California, and they perhaps have a contrary view, where it's a badge of pride to them that they have essentially engaged in this market transformation. Again, they also talk about themselves being a nation-state and the world's fifth-largest economy.

Respondent 2: For me, thinking about this there are least two different things going on here that are getting conflated.

Why is it a good idea for to invest in offshore wind? It might be that the answer is that it's carbon-free and therefore it helps us out and, if we had charged for carbon in a sensible way, we'd be able to capture that pretty clearly and we wouldn't have to have a lot of this conversation.

Second is, no, the reason we're doing it is because we're going to go down the learning curve and that's going to produce all these collateral benefits that are going to spill over to everybody else. So, everybody owes Rhode Island some money. Because they did it for us, and maybe we should do that. I think that to the best that I have read about this—and I admit I haven't looked at the actual numbers very closely in the last couple of years—but there was a National Academies study that I was involved in, which is trying to sort these things out and how much it's a separate thing perfect spillover story. The answer is it's probably there. You can estimate it but it's a lot smaller than you think.

So, for example, if you have a technology which is really expensive. And you're going to invest in that technology, because it reduces carbon and you're going to reduce the cost of that technology until it's no longer outrageously expensive, it's just expensive. Then you actually haven't had an externality problem there with the spillover. You just have a technology which is too expensive.

What you need is for the spillover argument to work as something that when it gets down low enough, it will take off by itself when we don't have to substitute it anymore and we're accelerating that process. And we get huge numbers because of all of the units that are

going to be built in the marketplace where it's beneficial to build them.

But if it's not beneficial to build them because they don't reduce the cost of carbon or they don't capture that much carbon, then it's not a benefit and it's not an appropriate externality. It's called in simple technological analysis a mistake, and you shouldn't have built it.

This is one of the arguments that I subscribe to, about why carbon pricing is so important, because it untangles a lot of these things, and you can see what's actually going on here and how much benefit you're getting from this and how much from that. But I think we shouldn't overstate how much the benefits of these spillover effects. It depends very much on future penetration conditions and whether or not it's ultimately actually beneficial. As opposed to, “We're going to build a lot of these things and they're really expensive, and if we build even more of them, we're going to waste even more money. But we'll waste a little bit less, because we have a learning curve effect.”

I think we have to unpack these, and I don't envy the regulator's challenge in trying to do that. But it is a very powerful argument to me why carbon pricing is so critical.

Moderator: Next question.

Question #9: Two questions. One is whether it's useful, given what we know about the transition that's going to be taking place, whether regulators are to actually put out requirements for cost mitigation strategies?

I'm thinking about avoiding stranded assets, but the point is equally valid that cost mitigation going forward for whatever transition we're making, whether the regulators ought to be looking to set guidelines or at least providing certain

expectations for what utilities ought to be doing or actors in the marketplace?

So, that's one. Whether we ought to be doing that, and if we do that, what does that look like?

And the second is, and it goes back to my concerns out of it from the 1990s, which is simply we're looking at stranded assets recovery costs. How do we make sure that we're limiting ourselves to those plants that are actually affected by climate change programs? As opposed to, for example, non-emitting but non-economic assets—e.g., nuclear—that they shouldn't be lined up for a cut. Because it's easy to see, if I were a lobbyist for a nuclear company, this is a wonderful opportunity for me to get some money for my client.

When, in fact, it has literally nothing to do with climate change. How do you avoid that sort of thing? Those are the two questions.

Moderator: Who would like to tackle that?

Respondent 1: I was listening to the first part of your questions, where you were requiring mitigation plans.

As I was thinking about this session, I was definitely thinking about now, when we have new fossil fuel investments that are being proposed to us, mostly in the gas utility, I think we do have a lot more responsibility now as a regulator to be asking, "Is this investment going to become obsolete within the amortization period? How much value are the ratepayers going to get out of it before it does become obsolete? What's the company's plan for maximizing or lengthening the useful life of its asset? And what does the benefit-cost analysis look like for that?"

I want to know, to the extent possible, what additional investments the utility is going to need to make over time in order to extend the useful life of the asset. And I want to know that now because later on they're going to look more beneficial, because you won't be counting the sunk cost of what's been invested today.

So, I'm definitely thinking along those lines, and I can't remember the second part of your question.

Moderator: Something to do with nuclear rent seeking.

Questioner: The second was, how do you avoid the expansion of the of the opportunity for stranded asset recovery to apply to non-economic assets that have nothing to do with climate change?

Respondent 1: Well, I can't answer your specific question there, but one of the things that I was thinking about in preparation is, is there a difference between stranded assets due to climate and stranded assets due to any other kinds of policies?

One thing that I brought up in our hearing room when our utility was asking for advanced metering, for example, is, if a big chunk of the advanced metering business case is time of use, the ability to provide time-of-use rates, there are so many—well, not so many—but there's a handful of different policies that could strike that from the value case, our legislature hates time-of-use rates and they could just flat out ban them.

Community choice aggregation is taking off, which will take a huge chunk of that benefits away from the distribution utility. I don't think that those are really different in theory. They're different in level of exposure, in scale.

Moderator: Anyone else?

One interesting thing I've taken away from this conversation as it's progressed is that, paradoxically, in some of the restructured jurisdictions, there seems to be more utility applications for pre-approval for the things they continue to be responsible for. And they're also seemed to be the growth of contracts, like actual legal contracts, unlike "the regulatory compact," that really will bind customers non-bypassably to paying for a project of the long-term. In a weird way, if that's the sort of future of clean energy policy, that it almost seems like that style of restructured market has more of the stranded asset risk associated with ratepayers than traditional utility regulation.

Again, depending on the jurisdiction, there's plenty of vertically integrated utility jurisdictions that have shifted a lot of risk over time, as well. But that's been one of the takeaways—that if you're going to commit to restructuring, you really need to do it or else, I think, to use one of the speakers' point, you might consider just going back to a more traditional form of regulation. That definitely counts as advocacy against one's own interests. That's why we speak as individuals, not as corporate representatives.

Respondent 2: Can I just ask you, an example you just went through, these are contracts with the utility and then they have a related rate-based business for the same utility?

Moderator: Right, these are the contracts we're talking about where, say, a utility T&D company signs the contract, like in Rhode Island, with a renewable developer, the contract passes, except for construction risk, all of them are to the utility but it's really passed to its monopoly base of customers.

I guess, in some hypothetical future, you could try to do something of that contract, but it seems to me, unless you really have the utility go under for some reason, the customers are pretty stuck with the risk of that stranded cost. Whereas, at least in some situations in integrated resource planning, you'll have a company like Berkshire who's willing to not seek pre-approval and maybe make a splash with a big wind investment in the middle of the west.

It's clear to the regulators that they've made that investment absorbing some of that risk of the managerial decision unto themselves, which does not seem to be a thing that's happening with these long-term contractual tie-ups in New England.

Respondent 2: I'm still trying to sort out—money is fungible, and I can give you money with one hand and take it away with the other. So how do you solve that problem? How do these contracts solve that problem? If I want to stick the utility with the stranded asset, isn't there enough flexibility that I could do that, even though I claim I was honoring all these contracts?

Moderator: Sure. And maybe you do see this in some jurisdictions where utility prices end up way out of whack for perhaps all sorts of reasons, one of them might be stranded assets.

Then a big storm happens and the regulator kind of gives a wink and says, "Your ROE should be a little bit lower." One of the contributing factors to the overall social disease with that utility might in fact be stranded assets. But that's a pretty attenuated bank shot that doesn't have a direct linkage to accountability for the stranded assets. But it's true.

I think to another topic within the stranded asset conversation, it's one of the reasons why the only thing that's really well beyond the kind of pinky swear of regulation and any of this is probably securitization, where you're literally holding in a special purpose vehicle, intangible property directly associated with consumers' liability to pay. Then the state law says some magic words about "the state pledges and agrees with the holders of any transition bonds that the state will never limit or alter or in any way impair these bonds" or something like that. I'm reading up about securitization recently.

But I believe the point still stands that the long-term contracts represent more of a commitment of consumers to pay for stranded costs than do integrated resource plans potentially —again, depending on the nature of local regulation.

Respondent 3: I love the analogy that these future long-term offshore wind contracts could potentially be the next round of strandable costs. Hoping that doesn't play out that way, but just some of their notional values are high enough that who knows what the future technology will bring and where it will value in 10 or 15 years. Because, for starters, you've got probably a three-plus year front end after the contract is awarded before it's in service, and there's a lot that can change between now and the mid-term of the contract.

So, an interesting question. I'm hoping future folks don't have to be wrestling with that as a future strandable costs. But part of it is there, depending on which way we go with, for example, carbon pricing. You could have a lot of existing RPS contracts look like windfalls if, all of a sudden, the market starts putting in a premium for carbon pricing for the physical power, and the contract wasn't adjusted for it.

So, we are figuring it out as we go along. I don't think we have come up with the right contractual or regulatory structure to foolproof uncertainty, because things will change. The only thing that we know is we don't know what the future will bring.

Moderator: A call for some closing comments. I think that's a good one. I'll go to the other panelists.

Respondent 4: Well, first of all, I just really enjoyed the conversation here and was especially interested to talk to all the thoughts going around. I think the next steps to me are looking at how we can use competitive structures to attract the capital investment and keep that with investors, rather than with customers. I think, throughout, this conversation highlighted so many examples of both problematic incentives and poor societal asset decisions. Then, ultimately, customers bearing the cost of those, when we don't have that proper allocation of risk.

So, I don't know. I think that a lot of this conversation speaks to the need to solve that problem.

Respondent 1: I have spent a lot of my time on the commission on efforts to hold the utility accountable to delivering on benefits and to not paying the utility for things that can't be held accountable to.

The pushback and the stakeholder anger and frustration that we have received in response to those efforts makes me worried that stakeholders in legislators will continue to fall prey to de-risking utilities in order to get them on board with things that they otherwise don't want to do. Or that the utility will, knowing that there's so much urgency and so much urgency on the part of stakeholders, that if they just dig in or drag their heels that

that stakeholders and the legislature will de-risk investments for them.

So, I guess that's my advice or my ask of stakeholders out there. It's not going to work in the long run. It may work at a pilot scale in the short run to de-risk the utility, but in the long run, when we go to scale, we're going to start to see a lot of funny interactions if we continue to do that.

Moderator: And, lastly.

Respondent 2: My response to the earlier question would have been, which I was just thinking about in terms of future stranded assets and creating new stranded assets—the big surprise to me would be if that turned out not to be true.

So, I just think, given the history of so many things change, I don't know what's going to happen. I don't know which ones are going to be vulnerable. But we're talking about a massive change with things that are expensive. Then, there's going to be a lot of surprises. I just don't see how this problem is ever going to go away.

Moderator: Well, it's been a great discussion, as I advertised it at the beginning: Stranded Assets, Old and New. Thank you for having me as your moderator. A round of applause for all of our panelists.