

**Gabriela Nagle Alverio:** Hello and welcome to Policy 360. My name's Gabriela Nagle Alverio, and I'm pleased to be sitting in as your host this time. I'm a JD Ph.D. student in the university program in environmental policy at Duke University. There's an idea, a big idea, that for many years has had economists and others excited when it comes to solving the riddle of our rapidly changing climate. It's called a carbon tax. And basically, the idea is this if carbon dioxide causes climate change, well, let's tax it. If we do put a tax on it, businesses and others will become much more aware of how much CO<sub>2</sub> they're pumping into the atmosphere. And that will be a good thing, a very good thing, for the planet. Carbon taxes have become popular in certain nerdy circles, very popular. Yale professor William Nordhaus won the Nobel Prize in economics for his work on the consequences of unchecked climate change and this idea of a carbon tax.

**William Nordhaus:** A carbon tax raises the price of carbon emissions to reflect the social costs. It also provides powerful incentives to reduce emissions. And as my fellow...

**Gabriela Nagle Alverio:** “The science is clear,” he said in this Nobel speech. “The economics are clear.”

**William Nordhaus:** And it is now up to those who represent us, our elected leaders, to act responsibly, to implement durable and effective solutions.

**Gabriela Nagle Alverio:** But recently, some policymakers in the U.S. have begun to turn away from this, quote on quote, clear idea of carbon pricing. Here to talk about why this is and what the alternatives might be is Brian Murray. He directs the Nicolas Institute for Energy, Environment and Sustainability here at Duke. Brian is widely recognized for his work on the economics of energy policy, including the design of market-based mechanisms to reduce greenhouse gases and deploy low carbon energy. Members of Congress, state legislators and regulators seek his counsel. Welcome to Policy 360, Brian.

**Brian Murray:** It's great to be here, Gabriela. Thanks for having me.

**Gabriela Nagle Alverio:** Absolutely. So first, can you describe carbon pricing for us? Like, how does this work?

**Brian Murray:** Sure. Well, strictly speaking, carbon pricing is effectively putting a unit price on carbon dioxide and other greenhouse gases that are emitted into the atmosphere or in some cases actually a price on those gases as they're removed from the atmosphere. Basic premise is it provides an economic incentive to reduce those emissions because currently they are unpriced. So, they're treated as free. And when it's free to emit greenhouse gases, we're not incentivized to reduce those emissions. It also follows the polluter pays principle. Though I should note that the polluters themselves who are going to be charged the tax or pay the price, have the opportunity to pass those costs on to their consumers so they are producing services for their consumers. They pass the costs of producing goods and services onto their consumers and that can also include the charge that there would be for carbon.

**Gabriela Nagle Alverio:** That makes sense. And so, so far, you've been a fan of this policy for tackling climate change?

**Brian Murray:** Yeah, and I would say I would say I still am. And, you know, I'll explain sort of the nuance behind that in a moment. I mean, I think reality is caught up with carbon pricing as a solution set, but it doesn't mean that it is pushed to the side. So let me give you two different examples of how carbon can be priced. You mentioned a carbon tax and that's essentially a fixed fee that's going to be issued by the

government and paid on all emissions from regulated sources, whether that's power plants or factories or cars or the fuels that are used in buildings. Another approach is called cap-and-trade, or emissions trading. And in a cap-and-trade program, the government issues a fixed number of permits, but they allow those permits to be sold in a market. So, in other words, if I am a firm that is emitting greenhouse gases, I need a permit to emit a ton of greenhouse gases and there's only going to be a certain number of permits that are going to be issued into the market. So, if I need more permits to issue more greenhouse gases, I need to buy them from somebody else who's able to reduce their greenhouse gases so that they won't need the permit. That creates the sort of forces of supply and demand, which then creates a market price for this emission permit. And it's that price that provides the same kind of economic signal to reduce emissions that a carbon tax does. But, what's different about those two is a carbon tax puts a price on and emissions can actually vary. We don't actually know what we're going to get in terms of emissions levels if we put a tax on it. We expect them to go down, but we don't know what absolute level we will get. For cap and trade or for emissions trading, we actually should know what the emissions are because there's only going to be a certain number of emissions allowed. And when the supply and demand forces work together, establishing a market price, we don't know what that price is going to be. So, the price could be lower, the price could be high. But we should expect the emissions to follow a trajectory set up by the policy itself.

**Gabriela Nagle Alverio:** And so far, has there been a preference for a carbon tax versus cap and trade, or where do people stand on that?

**Brian Murray:** Well, it has been widely used throughout the world. So, a recent study by the International Monetary Fund, or IMF, reports that there are about 46 countries pricing emissions either through a carbon tax or through an emissions trading scheme, and several others are considering it. And globally, the taxes in the trading systems cover about 30% of emissions and prices really, as I mentioned, prices can vary in an emissions trading system, and they've risen to as high as about roughly 80 to 90 euros per ton in the European Union to as low as 5 or 6 dollars in other parts where the cap is not as stringent as it is in the European Union. So, it's a wide, it's a wide range of prices that you actually see in the market.

**Gabriela Nagle Alverio:** Mmhmm. That makes sense. And I have been hearing, though, that there are some critiques about carbon taxes, even from people who are fans of climate policy. What are some of these arguments?

**Brian Murray:** So, there are a number. So, one is the notion that it's politically difficult, that there hasn't really been the political will. I think that's been true in the United States. There are two carbon pricing schemes in the United States, I should say, programs in the United States. One is in California. It's a cap-and-trade program. And essentially about 80 to 85% of all emissions in California are subject to a cap-and-trade system. Another is in the northeastern United States, just power plants. It's called the Regional Greenhouse Gas Initiative, and it covers now 11 states in the northeastern United States. Should there has been the political will in those places to put in a cap-and-trade program, but nowhere else in the United States has done this. Now, I first started getting into this about 10 or 15 years ago when I was part of a team of colleagues here at Duke and at other institutions working with the US Congress to help design and develop what a national cap and trade system might look like. And we got pretty far down in the design stage. And in fact, a cap-and-trade program did pass the House of Representatives in 2009 with many of the features that we had helped design. But at that time, we were

just still in the middle of a great Recession and the political will did fall apart in terms of it did not pass in the Senate, so it never became law. President Obama said he would sign it into law and if it was passed through the Senate to him and did not do that. So, it's been it's been a bit of a political challenge in the United States to get it passed. But, for instance, since then, there's a national carbon price in Canada, which is a mix of taxes and emissions trading programs in all of the different provinces of Canada. And as I mentioned, there's 45 other countries or jurisdictions in which we find pricing. So, the political will argument doesn't mean that it's never gotten any political will anywhere. It means that in the United States it's been a challenge. So that's one. Another thing that has recently come up and I think it's really kind of the purpose of this podcast is so for a while the only ambitious policy that people could think of in terms of greenhouse gases in the United States or elsewhere was a big carbon tax or a big comprehensive cap and trade program like I just described. And given that that net hadn't materialized in the last 10 to 12 years, when President Biden became president, there were a lot of people who said, well, now it's, now is its moment. This is going to be the moment for carbon pricing. But instead, what happened is a whole bunch of other types of policy approaches really kind of took hold. So, there was this notion that's been out there that carbon pricing is just an incrementalist type of approach. And what we need is something bolder than that. And, you know, I think I don't entirely concur with that point of view that pricing in and of itself can't be transformational or only nibbles around the margins. I mean, I think asking whether a carbon price works is a little bit like asking whether exercise is good for your health. Yes, it is. But it is how much you do and what determines how good it is. So, if I run, say, once every two months for a half a mile at a time, you can say I run. But it really doesn't have much effect due to the lack of frequency or exertion in my running. So other factors like heredity, diet, and luck are going to be the key determinants of my health if that's my running regime. Likewise, you can say your jurisdiction price is carbon, but if it does so with the very low tax or with the very modest cap of emission allowances, effects of the pricing are going to be very muted so that other economic policy and technological factors will be the key determinants of emissions. So, I don't know, I would not say that pricing doesn't work and therefore we have to turn to other things. We just haven't actually tried it at the level of ambition and scale that have been necessary to produce the types of outcomes. So that's one thing.

**Gabriela Nagle Alverio:** No, that makes a lot of sense. I mean, it sounds like the politics at play are just really massive, whether it's not getting it implemented in places where maybe it could have been or having it be implemented at a lower scale than maybe we would need in order to see efficient results. So that makes sense. I'm kind of curious what you think about the argument that a mixed strategy is what we need. What would that look like?

**Brian Murray:** So, I think a mixed strategy is what we need, and that's actually been always part of the prescription, right? When carbon prices, let's say when a carbon tax or a cap-and-trade program that auctions all of its permits or generates a lot of revenue for the government, all along, it's been envisioned as a revenue raiser, that one of the things that you could do with the revenues is to focus that on the types of things that bring down the cost of reducing emissions. So, improvements in technology or other types of incentive programs that bring costs down. So that's a package too. And sometimes it's called complementary policies. Complementary policies just mean that you're trying to do two things at once. And now probably the best way to view it is that rather than thinking of carbon pricing as being the central policy in the U.S., which now after the IRA and we'll talk about that is definitely not the case, rather than think about that being the central piece, the question is can it be the

complementary piece? Like can you have direct regulations or subsidized technologies? Are deep investments in R&D and grants and other ways to bring emissions down as a centerpiece, but still have a carbon price as a complement to that? People talk about this oftentimes as a belt and suspenders type of problem. In other words, you need, you know, so if your belt breaks, you still have suspenders to keep your pants from falling down. And so maybe thinking about carbon pricing alone with these other types of policies is also a good way to think about it. So, I think it's a false dichotomy, I think, to say it's either one or the other, I think it has to be a package.

**Gabriela Nagle Alverio:** That makes a lot of sense. I know that when I was an undergrad taking climate policy courses for the first time, we would talk about carbon taxes and cap and trade, and it sounded like it was the silver bullet. This is the thing that we need to do and put all our political capital behind. But it seems more right and more intuitive what you're saying that it's one tool in a whole toolbox that we need to think of together. And it would be silly to imagine that just one thing of anything could really fix such an intractable problem as climate change. So that makes a lot of sense.

**Brian Murray:** It's worth pointing out a couple of other things. So, when we talk about a cap-and-trade program and compare it to the carbon tax program, the fact is in the big programs where cap and trade have actually been imposed, we have seen declines in emissions because you kind of have to right, like there's a cap in that that cap is declining. So, to say that emissions haven't been reduced in those areas would not be a correct statement. The reality is, though, that what causes emissions to reduce, you can't just say that was all driven by carbon pricing. Of my own research, looking at the program in the northeastern United States, the RGGI program which I alluded to earlier that I worked on with a Ph.D. student of mine at the time from Duke, Peter, we found that the pricing program and the entire cap and trade program in RGGI did lead to emission reductions below what they would be without that program. But there's other things that have been happening as well, including it was a pretty significant time of change in U.S. energy markets when coal was starting to get replaced by cheaper natural gas that was coming online as a result of hydraulic fracturing. There was that there was economic activity was declining. And again, I referenced the recession of the 2008 and 2009 period that also leads to reductions in emissions. So, there's a lot going on. Like it was with the tax, if you look at a place like British Columbia that's had a carbon tax since 2008. emissions have not plummeted there. They have stayed flat to slightly rising. And what I do feel confident in saying is those emissions are lower than they would have been without the tax. But they didn't guarantee a reduction in the emissions. And so that's a policy choice. If you are going to take pricing, which approach you're going to use. One other thing is that a lot of people say, well, it doesn't work because of a phenomenon known as a leakage. And leakage means if you impose a carbon price in one jurisdiction, it just means that it's going to shift activity or emissions to another jurisdiction. And what I would say to that is that it actually shows you that pricing is working because it's saying I'm going to reduce my emissions here in response to this price and now I'm going to go over to some other place that doesn't have a price and emit there, willing to make investments in moving my capital and losing my activity to other places, incurring costs to avoid this price, shows that the price works. The solution to that is to have pricing or any kind of regulation in a wider range of areas, in a wider range of jurisdictions. So, wherever you have a situation where something is being regulated in one place, it's not being regulated in another place, we can always expect this type of leakage to occur, not just in carbon pricing schemes.

**Gabriela Nagle Alverio:** Right? That definitely seems like common sense, but something that I feel like people complain about when it's just, you know, normal, normal solutions to happen. So that makes

sense. And, you know, now I do kind of want to pivot. I'm sure your opinions have changed over time as to what makes sense, but what's exciting you right now about climate policy?

**Brian Murray:** Well, I think I referenced the IRA earlier, the Inflation Reduction Act that was just passed in August, much to the surprise of just about everyone I know, including people who work in the administration, this is massive in terms of relative scale to any other climate policy, and it is a climate policy, it's just Inflation Reduction Act, it's really mostly about energy. And most of the energy is about low carbon energy or zero carbon energy. So, it is a big climate policy, you know, with an expected expenditure of \$370 billion. Most of what that is about is providing subsidies to zero carbon technologies like wind and solar or carbon capture and storage or new advanced nuclear technologies or keeping current zero carbon nuclear plants around. So large subsidies to induce private activity to undertake those activities. The expectation is that that will reduce emissions anywhere from 40 to 50% below 2005 levels by the 2030 to 2035 timetable. So that's very exciting in part because most people you know, partly because most people didn't see it coming. But that's only for people who watch Washington as sport. But it's exciting because what it's really going to do is it's going to amplify the amount of capital being spent on zero carbon technologies because these are just incentives to spend private capital. So, this is going to create expenditures in the trillions of dollars, not in the hundreds of billions of dollars. And that's pretty exciting.

**Gabriela Nagle Alverio:** Yeah, that's really exciting. And what concerns you when it comes to where we find ourselves now? Like, where should we be focusing on?

**Brian Murray:** Well, I don't think it's changed that much. The pathway that we should be focusing on right now and which we are focused on right now, which we're actually seeing progress in right now, is cleaning up our electric power generation. So, moving, you know, for a decade or so, there was a lot of movement from coal to natural gas. And then there's been movement from coal and natural gas to renewables. There's been a sustained level of nuclear, and nuclear has its own challenges, cause challenges, safety challenges and whatnot. But there's some potentially promising new nuclear technologies that are both safer and cheaper that are being considered. I mean, they're part of the incentive program that I just described. So, we need to be focusing on cleaning up the electric grid and then and then moving more towards trying to electrify more of our end use as energy. So, we're already seeing this with electric vehicles. Other areas where we can see more electrification within home heating and cooling, whether it's moving from gas and oil furnaces to heat pumps or gas water heaters to electric water heaters. These are all ways of reducing the emissions fossil fuel use in households to electricity and with a cleaner grid that leads to net reductions in emissions. So those are exciting. The big challenge is how do we make progress in some of the and some hard to abate sectors? Hard to abate sectors like the industrial sectors, cement, chemicals. They need extremely high levels of heat generated often which can't be generated by electrification. It is required to use natural gas for the most part in a lot of places in coal. In some other cases, to get, you know, temperatures up into the thousands of degrees Fahrenheit. So, we need new fuels in order to do that because I don't think we can electrify everything. So, hydrogen is pretty exciting. You know, hydrogen was always a decade or two away, but now it seems like we're a lot closer than that. And the hydrogen we're talking about is hydrogen that can be created using renewable energy. So, we use electricity into an electrolyzer and the electricity comes from wind or solar or some other zero carbon source. And that hydrogen is then considered sort of emissions free in terms of having CO<sub>2</sub> effects, and that can be used as an industrial gas. Other areas that are hard to decarbonize are aviation, long term trucking, shipping, and these are all areas that are going

to need work and we don't have the solutions right now. We're working towards them, have a pretty good playbook to work with, but they're not ready to be implemented right now. So one of the messages I think to keep in mind is even though we have to hurry up, there's still a sequence that makes sense to follow, which is to decarbonize what we know how to decarbonize relatively well right now and then try to move that decarbonization to other parts of the economy that are having a harder time decarbonization and then continue to develop technologies and practices that can help reduce emissions in those harder to reduce sources over the next one to 2 to 3 decades.

**Gabriela Nagle Alverio:** Absolutely. And I mean, this kind of flows directly from that in terms of all the challenges and the path that we have to go. A lot of that is going to be done by future climate leaders. And you have an important role here at Duke in training those leaders. Is there something like some nugget that you try to pass along to them when it comes to the leadership that it's going to take to tackle all the things we just talked about?

**Brian Murray:** Yeah. Gabriela, I think you're referring to our recent announcement of the new climate commitment, which aims to deploy all aspects of the university's mission education, research, engagement, public service, campus operations and community partnerships, all those things in pursuit of sustainable and equitable solutions to climate change. So, you know, climate change is a really wicked challenge. I mean, it's a necessary challenge. I mean, it is among the most significant challenges of our time. Many of us feel the most significant, but it requires a multidisciplinary approach or an interdisciplinary approach. So, from the natural sciences and engineering to the humanities and to professional training, we want all students to have at least some exposure to the climate challenge, to understanding climate change, a basic level of literacy on that. But we also need to provide depth for those who choose to specialize in key parts of the climate problem. And so, when we put breadth and depth together like this, we think of this as like climate fluency and what level of knowledge is necessary to tackle these problems, in what parts of our society and what parts of our economy. And we are trying to train people with this climate fluency that can be changemakers, that can be changemakers when they're here on campus, but soon after they leave campus. And we're not just talking, you know, you know, we're a university, we educate students, but we also have a lifetime commitment with our alumni and with other partners of this university. And we need to commit to providing fluency to them to give them an opportunity to make change. And we have a lot of exciting programs that we're thinking about that we are developing right now to work with all these populations, the students, the faculty, the alumni are our partners outside of the university. And that that is what I've always that's why I came back to Duke. I went to graduate school here and I came back in 2005 to come to the Nicolas Institute, which at that time was the Nicolas Institute for Environmental Policy Solutions. And now we've merged the Nicholas Institute for Environmental Policy Solutions and the Duke University Energy Initiative into the Nicholas Institute for Energy Environment Sustainability in large part to focus on these climate problems and other sort of environmental problems that are just exacerbated by the climate threat.

**Gabriela Nagle Alverio:** Well, I have to say I'm with you on the fact that climate is the biggest problem that we're facing as a society and also feel really lucky to be one of those students that's part of the climate commitment and who gets to be, you know, benefit from all the wisdom at the Nicholas Institute and at Duke broadly. So, with that, I will thank you so much for your time and for sharing this with us. It's been a pleasure to talk with you.

**Brian Murray:** Thank you, Gabriela. And I appreciate you being one of those students who is making change throughout the world. Keep doing it.

**Gabriela Nagle Alverio:** And thank you. Brian Murray. He directs the Nicholas Institute for Energy Environment and Sustainability here at Duke. He's also a professor at Duke's Nicholas School of the Environment and Sanford School of Public Policy. This series of climate conversations is part of a larger initiative here at Duke. It's called Duke's Climate Commitment. You can find out more about that at our Web site. Policy 360 dot org. It's been such a pleasure pinch hitting for Judith Kelly for this episode, especially for this series of climate conversations, a topic that's near and dear to my heart. Judith Kelly will be back soon with another climate conversation. I'm Gabrielle Nagle Alverio.