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Meredith Fowlie: The impacts of climate change are so palpable and just so pervasive that the number of students who have decided to make it their life mission to do something about it… I think it's going to change the trajectory of many, many youth who are going to have a really profound impact on how we tackle the problem in future generations.

Rob Stavins: Welcome to Environmental Insights, a podcast from the Harvard Environmental Economics Program. I'm your host, Rob Stavins, a professor here at the Harvard Kennedy School and director of the program. I've had the pleasure of including in these podcast conversations over the past three years a number of leading economists who have carried out important work in the realm of environment, energy, and resource economics, many of whom have been long-time leaders in the profession. So quite naturally, that has frequently led me to engage with the gray-haired set from my generation.

But today, for that reason, I am very pleased to include in this podcast series someone who is decidedly younger than many of the people I've previously had the pleasure of talking with. But someone who, I hasten to add, is a full professor at the University of California Berkeley, has in the past and continues to carry out important research. I'm referring to Meredith Fowlie, Professor of Agricultural and Resource Economics and co-director of the Energy Institute at Haas, both at UC Berkeley. Welcome, Meredith.

Meredith Fowlie: Thanks so much for having me, Rob.

Rob Stavins: So, before we talk about your research and your current thinking about energy, environment, and climate policy, let's go back to how you came to be where you are. So where did you grow up?

Meredith Fowlie: So I grew up in Toronto, in Canada.

Rob Stavins: And does that mean you went to both primary and high school there?

Meredith Fowlie: Yep, I was there all through high school, spending most of my time pretty much in the center of the city, but also had the good fortune to spend a little bit of time in the summer north of Toronto at summer camp.

Rob Stavins: And from there though, then after you finished high school, did you immediately move to the United States for college?

Meredith Fowlie: I did. Actually, I went to Cornell and I think one thing we both have in common is we spent some quality time in Warren Hall. So I went to-

Rob Stavins: That's right.

Meredith Fowlie: ... Cornell's College of Agriculture and Life Sciences.

Rob Stavins: And you did both a Bachelor's degree there in International Agriculture and Development, if I have it correct?

Meredith Fowlie: You do. You do, yep.

Rob Stavins: And then you stayed on to do an MS degree in Environmental Economics?

Meredith Fowlie: Pretty much. There were a couple years of wandering in between. I started off not in economics, I went to study Environmental Science and Ecology and Agriculture, talk a little bit, I stumbled into an Environmental Economics course, which really piqued my interest. And then I left and came back to do a Master's a few years later.

Rob Stavins: So do you remember who was the instructor in that course that piqued your interest?

Meredith Fowlie: Oh, very much. I think it was Duane Chapman and Duane-

Rob Stavins: Oh gosh.

Meredith Fowlie: ... is the reason, he is the reason I'm an environmental economist. So I went to college. I was very motivated to study more physical environmental dimensions of science and environmental problems because as a kid, as I mentioned, I went to summer camp north of Toronto, and you mentioned I'm not a gray hair, I have plenty of gray hair now. I spent my summers, late 80s or early 90s canoeing and hiking around Algonquin Park and the Temagami Wilderness. And at that time, acid rain had really taken hold. There were lakes that were crystal clear because there was nothing alive in them. Year by year you could see the trees dying. And so this had a pretty powerful impact on me.

So I actually went to Cornell to try and better understand acid rain in particular, environmental problems more generally. And I thought my angle was going to be environmental science, but I quickly came to understand that at least when it comes to acid rain, the science was pretty straightforward. Scientists understood what was happening, and really the problem had everything to do with, we needed to find ways to incentivize the firms that were contributing to the problem to invest in solutions. And so I almost accidentally stumbled into Duane Chapman's Environmental Economics class. And I think the very first lecture, it was around 1996 when the acid rain program was just getting underway, and in one of his opening lectures he started talking about how

economists had set up this market, which was designed to give polluters a financial incentive to adopt abatement solutions. And he blew my mind and that was the beginning.

Rob Stavins: Oh, that's great. That's actually a topic that's come up in previous discussions in this podcast series, the Clean Act Amendments in 1990 and the SO2 Allowance Trading Program, people like Dick Schmalansee, who was on the Council of Economic Advisors at the time in the George H.W. Bush administration, of course worked on it. And I actually had the pleasure of working in that White House as well on developing that.

Meredith Fowlie: I remember that well, yes.

Rob Stavins: Let me ask you then, Meredith, you did an MS in the same department in 2000. Is that right?

Meredith Fowlie: I did. I did. But in between there, so Duane, he really changed the way I thought about economics and about economists, and he was very generous with his time. And so I spent a lot of time in his office, but I still wasn't convinced that economics was where I should head. But then upon graduating, I left and wandered around. I spent some time working in Pakistan, got really interested in energy infrastructure. And I also, I ended up working in Oxford.

My now husband was visiting Oxford and I sort of tagged along and somehow convinced the folks at the Oxford Institute for Energy Studies to just let me sit at a desk and work as a research assistant. And that was like 1999 when the UK was in the process of deregulating its electricity sector. So, I learned a lot by osmosis about electricity restructuring and the market design issues. So, it was then that I really decided I wanted to become an economist, or at least get the tools to better understand what that meant. And so went back to Cornell and worked with Duane to do a Master's having convinced myself that this was worth the investment and was something I was really, really interested in.

Rob Stavins: So, my recollection, at least when… I also did a Master's degree in the same department, what at the time was the Agricultural Economics department. And at that time, one did a very serious Master's thesis, unlike a lot of Master's degree programs that are just coursework. Did you do a thesis as well?

Meredith Fowlie: I did. I don't know how, it felt serious at the time, and it actually was what led me to Berkeley. So, Duane Chapman was really ahead of his time in many respects. He was working on climate change. He was working on renewable energy. I think he knew at that time that the electricity sector was really going to have a central role to play in decarbonization.

So, he went to Berkeley and he recommended that I go to Berkeley and I worked with the folks at the Lawrence Berkeley National Lab and we were studying green power. And so we were interested in whether customers would

pay more for green power as part of this move to restructure the electricity sector. So, it was really, for me, a great way to connect the dots between the electricity restructuring that I'd heard a lot about in the UK when I was there, and my real passion which was trying to understand environmental problems and solutions. And so we were really trying to understand what restructuring and retail choice could mean for the environment.

So, not the deepest analysis I've ever done, but a really nice opportunity to understand what it is to ask a research question and to try and answer it.

Rob Stavins: Absolutely. So, Meredith, so you went out to Berkeley working at one of the labs? Is that what you were saying?

Meredith Fowlie: Just as a Master's student, yes. I got to visit Berkeley. I'd never been, it was an amazing place. I was in the lab up the hill from campus, but got a taste of what campus had to offer.

Rob Stavins: Right. And so then that got you interested in applying to the PhD program in Ag and Resource Economics at Berkeley? Is that how it happened?

Meredith Fowlie: Exactly. Exactly. So I was there, got to meet with some of the PhD students and really got a glimpse at what it would be like to be a PhD student there. And so-

Rob Stavins: So tell me, what was your dissertation and who was on your dissertation committee? Who were your advisors?

Meredith Fowlie: Yeah, it was a great time, not a great time for California, but a great time to be a graduate student in Environmental and Energy Economics. So my advisors were Severin Borenstein, Catherine Wolfram, and Jeffrey Purloff. And when I arrived in Berkeley, the state was in the midst of an electricity crisis, as you may remember. There had been rolling blackouts and Grey Davis had to declare a state of emergency and he got recalled. So, around the lunch table, which still meets even to this day, you had economists like Severin Borenstein and Catherine Wolfram and Frank Wolak and Jim Bushnell all arguing over what had happened and what could have been done differently and lessons learned. So a lot of the PhD students around that table ended up writing dissertations about the electricity market thanks to those conversations.

But at the same time… so Davis was recalled. Arnold Schwarzenegger became the governor, and while I was in graduate school, he had decided to throw his weight behind policies to promote clean energy and fight climate change, was a really interesting time. At the same time we were trying to reinvent electricity markets. The state was also really leaning into some pretty ambitious climate policy that put the electricity sector at the core. So my dissertation was a lot about emissions trading, getting back to that Duane Chapman opening lecture. So, I thought a little bit about the intersection and interactions between the design of pollution markets and electricity regulation. And also was thinking

quite a bit at that time about emissions leakage. So, what it means to be a jurisdiction that puts a price on carbon when your neighbors don't, and how that could lead to a shift in economic activity out of the jurisdiction and along with that, a shift in emissions. So it was basically a dissertation, three papers, all about pollution markets and economic regulation and how those two worlds interact or collide as the case may be.

Rob Stavins: Now talking about leakage, do I have this correct? I have a vague recollection that the first time I read the phrase contract reshuffling was in a paper that you were a co-author of.

Meredith Fowlie: I can't claim it.

Rob Stavins: Is that fair?

Meredith Fowlie: Well, I don't think we created the term.

Rob Stavins: No, I'm not saying you did. I'm just saying it's the first time I heard it.

Meredith Fowlie: No, that may be. We really wanted to elevate consideration of reshuffling because in some sense, what reshuffling really refers to, it can be thought of as a form of leakage. But the concern, and I think I do a lot of work in California, not because I think California is the center of the universe, but it is a laboratory for climate policy experimentation. And the state's been running into problems first and trying to figure out how to solve it.

So, one concern in California is California has one of the worlds', if not the first, border carbon adjustment. In our electricity sector we stand at the border and try and price the carbon embodied in our imports. And so on the one hand, you might think that solves the leakage problem, we're taxing carbon that's in the imports and therefore expanding the scope of the regulation, but the concern with reshuffling, of course, is what can happen is if an importer knows that the carbon embodied in her imports is going to be taxed, she'll prefer to import the clean stuff. The coal plants don't turn off; they just get reshuffled to another jurisdiction that's not imposing the same regulatory constraints. So yes, it was an interesting problem to work on and continues to be, I think, an important consideration as we see the scope of border carbon adjustments expand.

Rob Stavins: So in 2006, you received your PhD from UC Berkeley, and then you moved east. Tell us about that.

Meredith Fowlie: We moved to Michigan, so back towards where I grew up. So I was really fortunate to get a job at the University of Michigan. I was joint between the Ford School of Public Policy. I also had an appointment in the Economics Department.

Rob Stavins: And you stayed there for three years? Do I have that right?

Meredith Fowlie: Three years, yep, you're exactly right. Three years. And I had just an amazing group of colleagues, Jim Levinson, John Dinardo, yep… lots of great people at the school and really enjoyed it there. But my husband was not on a tenure track and wanted to be, so we went back on the market. Fully intending actually to stay in Michigan if he could get a job in Michigan, but we were fortunate to get two positions offered back in Berkeley.

Rob Stavins: Oh, wonderful. So that's how you returned to Berkeley?

Meredith Fowlie: That's how I returned, yes.

Rob Stavins: So you returned as an assistant professor in more or less a lateral move, become an associate professor, and then a full professor in 2021. And along the way, you became faculty co-director at the Energy Institute at Haas. So a lot of the listeners to this podcast will be very familiar with the Energy Institute, but there will be quite a few people who are not. So can you tell us about it? What's its mission and how does it pursue that mission?

Meredith Fowlie: Yeah. So I was really honored to become a co-director because it was really, as a graduate student, it had a tremendous impact on the questions I asked and the approach I take and just the experience I had as a graduate student. So, it's a group of faculty and graduate students at UC Berkeley, although we do have affiliates at other schools as well, and the unifying theme is policy relevant and largely data-driven research on energy markets and environmental policy, not just in California, although a lot of our work does tend to be in California just because we're there and we have lots of great relationships with different stakeholders. It helps us really understand what the pressing policy questions are. But it's a group of researchers trying to do high quality research that is anticipating policy challenges and trying to offer useful and constructive insights from the research that we do. So yeah, it's a great community that I'm proud to be part of.

Rob Stavins: So, let's focus in on your work in the world of environmental and energy and resource economics scholarship. I know this is like asking you to identify your favorite child, but what's the one research publication of yours that you are most proud of?

Meredith Fowlie: Oh, boy. Can I ask the question I wish you'd ask, which is the one research line of inquiry? So, I struggle to pick favorites, but I can pick a favorite question that I've answered in a couple of ways. And that is just the question about how economic regulation and environmental regulation interact. And that may sound very dry to some of your listeners, but I think it's just becoming more important by the day. So, going back to my dissertation work, I was thinking about the economic regulation of power plants and electricity markets, so regulators limit the prices that those firms can charge and determine how those firms can recover both the capital investments that they make and also the operating costs that they make.

I was really fascinated by the fact that you can have a pollution market that covers power plants in these different electricity markets that face different regulatory incentives. And what I found back at that time is indeed, you can have permanent market outcomes that depart from what you anticipate will happen because these different power plants face very different economic incentives in their respective markets. And in some cases, you can fall pretty far short of the cost minimizing allocation of pollution abatement investments given this asymmetry.

So back then, I was very much thinking about this as a complication that we should be aware of and anticipating when we design our environmental policies. Fast forward to today, when we think about the industries that are on the front lines of climate change – that's electricity; it's natural gas; it's insurance – a lot of these sectors and firms are subject to economic regulation. Regulators determine what investments get made, how costs get recovered, what prices get set. And I'm increasingly seeing that as less as a bug and more like a feature. We have these economic regulatory tools at our disposal, and if we start thinking about them like climate policy tools, we can actually get a fair bit of leverage out of those tools.

So, now I'm thinking about how public utility commissions set electricity rates in particular and thinking about how those regulatory decisions have pretty profound implications for how we mitigate climate change and who pays the price. So I know you asked for a paper. There are a couple papers along the way that are all getting at this question of economic regulation and how it sort of interacts with our climate and environmental policy goals.

Rob Stavins: Now turning to another element of your work, Meredith, you were a co-author with Michael Greenstone and Catherine Wolfram, both previous guests on this podcast series, of an important, and as I recall, quite controversial paper published in 2018 -- "Do Energy Efficiency Investments Deliver?: Evidence from the Weatherization Assistance Program." Can you give us a very brief description of the analysis, what you found? And also tell me if my memory is correct, and it was quite controversial among some members of the broad policy community, and I'd love you to comment on that.

Meredith Fowlie: Yeah, sure. So your memory serves, this was joint work with Catherine and Michael. It was back at the time of the Obama administration had injected a lot of funds into the largest residential energy efficiency program in the country, the Weatherization Assistance Program. We were interested in evaluating the impacts of that program. So the research question was pretty simple. This is, we're making big investments in this low income energy efficiency program. What impact is the program having on energy savings and energy consumption? And what we found, and we came to this with no prior thinking about what we were going to find, we just wanted to know what impacts this program was having. And so we were able to design a field experiment to randomize the take up of this program.

And what we found disappointingly, so there's sort of bad news, but then I think there's been some good news. So the disappointing finding was that these energy efficiency investments were not delivering as we hoped or promised. So, the way the program works briefly is that a household applies to participate in the program. An auditor comes, an energy efficiency auditor, takes lots of measurements of the home, projects the savings of different investments, be it furnace replacements or new windows. And then if the intervention passed the cost benefit test, well then taxpayer dollars are used to make the investment. What we found was that the energy savings were less than half of what engineering projections had anticipated. So, that was a disappointing finding. It just meant that we weren't getting the savings that the models projected and that the program wasn't delivering as hoped.

I think it was controversial insofar as our findings were disappointing; those savings weren't showing up as the models were predicting. I do want to quickly promote some research that the RA on that project, Erica Myers, has been doing. So Erica was a research assistant on that project. She helped us tremendously with both the field experiment and the analysis. She has gone on to chart a research agenda of her own and she's been doing some very exciting research still on weatherization. So, a 'for example' finding is that if you incentivize the workers who are making these improvements on the home, such that their compensation depends partly on the performance, you can significantly increase the effectiveness of those investments. And has also been able to identify those investments that perform the best in order to help target some of these weatherization investments.

Rob Stavins: That's interesting. But going back to your paper, the 2018 paper, some of the pushback, I remember at the time, was very, very strong. I'm not asking for the names of people, but more I'm thinking institutions or whatever. Where was the pushback coming from?

Meredith Fowlie: I think some of the pushback that I remember, and had some really useful conversations, was from the Department of Energy. The Department of Energy has been implementing this program for some time. So, I think there was, on the one hand, some disappointment with our findings and some concern, and I think part of the concerns stem from what are sometimes referred to as the non-energy benefits that we weren't able to measure. So, I think some of the concern was, you are measuring energy savings, you're measuring reductions in energy bills. There could be other, harder to measure benefits from these programs that you're not capturing. So, I think it was both a disappointment with what we were finding and also concern that our analysis might not have been as comprehensive as one might hope when we're thinking about these kinds of programs.

Rob Stavins: So, thanks for that. Moving from 2018 to closer to the present, something that's been quite prominent over the last several years, both in the policy world and in the scholarly world of environmental economics, has been much more attention to what gets labeled as environmental justice or the just transition. Obviously

environmental justice was a big issue in California long before it was in Washington and nationally. But in the last few years, it's become more and more prominent. So I'm very interested to know what your reaction is to that increased attention.

Meredith Fowlie: Yes, thanks for raising it. I think it's important. I think it's important and I think it's important in so many respects and so briefly, and I'm happy to dive into either of these areas or not, I've been thinking about these elevated concerns in a number of respects. One is, who is paying for climate mitigation and adaptation? These are needed investments, but how we make these investments has some implications for who ends up paying, and sometimes that's unintentional.

So, one part of my research is really thinking about how we're paying for climate mitigation and adaptation and who ends up paying the price. A second concern is cap-and-trade programs and the environmental justice concerns about those programs, particularly in California and program design changes we could consider making in light of those concerns. And third, this is something that I appreciated, it took me some time to really understand the importance of it. I think often as environmental economists, we think about who wins and who loses under these programs when we're thinking about environmental justice, but equally as important is process justice, meaning making sure that these communities are at the table when we're having those conversations.

Rob Stavins: So, you mentioned environmental justice concerns regarding the cap-and-trade system on CO_2 in California. Is the focus on correlated pollutants? Is that what it's about?

Meredith Fowlie: Yes. Yeah. So, I mean you might think this is a cap-and-trade program for greenhouse gas emissions. Those are global pollutants. The climate impacts are kind of independent of where they happen. The fact is that greenhouse gas emissions are often, as you just mentioned, co-emitted with local air pollution. Local air pollution problems continue to be an issue in disadvantaged communities. Disadvantaged communities in California do suffer more than their fair share, I think, it's fair to say.

And so even though economists, you and me included, have argued in the past, climate policy is climate policy. Let's not try and use one instrument to tackle two or three problems. Let's tackle climate problems with climate policy and air quality problems with air quality regulations. I am coming to appreciate the importance of the environmental justice community's concerns about cap-and-trade program and thinking increasingly about how one might respond to those concerns with modifications to climate policy design, in addition to elevating our direct efforts to mitigate local air quality problems in these communities.

Rob Stavins: I see. So, that prompts me to ask one other question about how your thinking may have evolved, and it has to do really with youth, people who are younger than you. I'm referring to these youth movements of climate activism, obviously

most prominently Greta Thunberg, but it goes beyond her. I'm sure you've sensed it on the student body at Berkeley and perhaps in high schools and primary schools. I've certainly seen it in Europe and the United States over the last several years, with a bit of a hiatus during COVID. I'm interested in your thoughts on these youth movements of climate activism.

Meredith Fowlie: I am encouraged by the youth movement. So, I teach at Berkeley, and I think I'm increasingly, as I get older, I think that the way I can have the most impact is through teaching these students. I don't always agree with them, and one of the reasons I really enjoy teaching at Berkeley is our job is to really provoke and challenge and engage these students. So, yes, I think it's encouraging. There's a sense of urgency among the students I teach that I think is important and I want to encourage. And so, I have learned a lot talking to them about their concerns and their impatience and their frustration. And I hope they've also learned from me about some of my concerns with how they want to move forward and what approaches they want to take.

Rob Stavins: And I wonder, and I'm interested in your thoughts on this, to what degree is this an age effect as opposed to a cohort effect? Usually as people get older, they tend to become somewhat more conservative in their views, or is this not really going to be an age effect, but a cohort effect and that these people that are demonstrating outside of the annual conference of the parties will be inside the negotiating halls working aggressively ten years from now? What do you think is likely the future that will come from this youth climate activism we're seeing currently?

Meredith Fowlie: I think it's a cohort effect. I mean I think my experience canoeing through forests that were dying changed the trajectory of my career because I could see it around me and it had such an impact. And when I talk to these students, the impacts of climate change are so palpable and just so pervasive that the number of students who have decided to make it their life mission to do something about it, I would think that that has, I mean there's certainly a youthful energy in terms of the level of commitment they're bringing, but I think it's going to change the trajectory of many, many youth who are going to have a really profound impact on how we tackle the problem in future generations, or at least that's my hope.

Rob Stavins: Well, that's a very positive and optimistic, and as you said, hopeful point at which to bring our conversation to a close. So, thank you very much, Meredith, for having taken time to join us today.

Meredith Fowlie: Thank you so much for having me. It was an honor and a pleasure.

Rob Stavins: So, our guest today has been Meredith Fowlie. She's a Professor of Agricultural and Resource Economics and co-director of the Energy Institute at Haas, both at University of California Berkeley. Please join us again for the next episode of Environmental Insights: Conversations on Policy and Practice from the Harvard

Environmental Economics Program. I'm your host, Rob Stavins. Thanks for listening.

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