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Guest: John Holdren
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John Holdren: The impacts of climate change are now so conspicuous that it is becoming impossible for people to, with any credibility at all, deny that this is an immense challenge to well-being on the planet.

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 Environmental Economics Program and our Harvard Project on Climate Agreements.

Rob Stavins: In this series, I've had the pleasure of engaging in conversations with a really stellar group of men and women with tremendous expertise in energy and environmental policy, some of whom have combined substantial work in the academic world with very significant service in the public sector. And my guest today truly exemplifies that combination. John Holdren is a research professor and until recently was the Teresa and John Heinz Professor of Environmental Policy at the Harvard Kennedy School and a professor in the Department of Earth and Planetary Sciences at Harvard. He took an extended leave of absence from the university from January 2009 to January 2017, to serve in the Obama Administration as the president's science advisor and as director of the White House Office of Science and Technology Policy. And he was in fact, the longest serving science advisor to the president in the history of the position. Before coming to Harvard, he was a long-time faculty member at the University of California, Berkeley, where he co-founded the well-known Energy Resources Group. John, welcome to Environmental Insights.

John Holdren: Thank you. It's great to be here, Rob.

Rob Stavins: And it's great to have you.

Rob Stavins: I'm very interested to hear your thoughts about the current state of climate change policy and energy policy, which has been a major focus of yours for quite some time. But before we talk about that, let's go back to how you came to be where you are and where you've been. And when I say go back, I always mean go way back. So tell us, where did you grow up?

John Holdren: I grew up in San Mateo, California on the San Francisco Peninsula and attended public schools there through high school.

Rob Stavins: And then you went to college where?

John Holdren: I went to MIT. Most of my friends from high school went to Stanford or Berkeley, but I wanted to see how the other half lived. So I went to MIT.

Rob Stavins: And when you went to MIT, did you know what it was that you wanted to major in or did that evolve while you were there?

John Holdren: I really did. When I was in high school, I became fascinated by the big interdisciplinary problems at the intersection of science and society. I wanted to get an education that would be very strong in science, but also very strong in social science and humanities, because I actually intended from the time I was a junior in high school to find a way to work at that intersection across the disciplines.

Rob Stavins: That's remarkable given how things turned out that you actually foresaw that and wanted it at such a young age?

John Holdren: Well, it was because of a couple of books I read as a junior in high school. One of them was C.P. Snow's book, “The Two Cultures,” which argued that many of society's most important and difficult challenges sat in the gap between natural science and engineering on the one hand, and humanities and social science on the other, and that the world was very short of people who were trained in operating in that gap. And that book persuaded me that I wanted to be one of those folks who was able to move between those two cultures and work on the problems that required insights from both.

Rob Stavins: So from there, from MIT, did you go directly to Stanford for the PhD?

John Holdren: Yes, I did. I got two degrees at MIT in aeronautics and astronautics, with a very strong minor in German philosophy and literature, and another minor in space physics. And then I went to Stanford to work on a PhD in theoretical plasma physics because it was interesting, it was hard, and I felt that if I succeeded in theoretical plasma physics and then moved into interdisciplinary work, no one could accuse me of not being able to make it in a discipline.

Rob Stavins: That certainly sounds right. But let me ask you for the sake of our listeners and actually for my sake as well, what is plasma physics?

John Holdren: Well, plasma is the fourth state of matter. If you think you start with a solid and you heat it, it becomes a liquid. If you heat it some more, it becomes a gas. And if you heat the gas enough, the electrons are peeled off the ions and it becomes an electrically conducting gas, which is a plasma.

Rob Stavins: I see. And so you studied plasma physics. Your PhD dissertation itself, I assume, was in that realm, is that right?

John Holdren: It was in theoretical plasma physics. And it led to my first post PhD job, which was as a physicist in the theory group of the magnetic fusion energy division at the Livermore Lab.

Rob Stavins: And the Livermore Lab, for those who don't know, tell us about its location.

John Holdren: The Livermore Lab is located about 50 miles east of Berkeley in the Livermore Valley. It is one of the nation's nuclear weapon laboratories, was founded as a twin to the Los Alamos nuclear weapons lab. But typically about half of the work that goes on there is not related to nuclear weapons, but is broader science and technology work. And the magnetic fusion energy program was one of the unclassified programs there in which plasma physics is applied to the challenge of harnessing fusion as a practical energy source for society, a challenge that has been pursued for about 70 years now and which still has not succeeded.

Rob Stavins: Right. Now, from there, you went directly west to UC Berkeley, is that right?

John Holdren: Not quite right.

Rob Stavins: Okay.

John Holdren: While I was at the Livermore Lab, I was teaching for a day a week at Berkeley as a lecturer in an interdisciplinary program which was just getting going there. It was called the ecology of electric power production and utilization. And I taught there from 1970 till 1972, when I took a leave of absence from Livermore. And I went to Caltech, the California Institute-

Rob Stavins: I see.

John Holdren: ... of Technology to work with another one of my mentors, the late great Harrison Brown, a geochemist who was also the foreign secretary of the National Academy of Sciences and a great international scientific statesman. I couldn't resist the opportunity to learn from Harrison Brown for a while. And so I went to Caltech and had a joint appointment in the Environmental Quality Laboratory and the Caltech Population Program in the Division of Humanities and Social Sciences.

Rob Stavins: And then from Caltech, you went north to Berkeley?

John Holdren: Exactly. In January... Well, excuse me. I was appointed in January, but I showed up in July 1973 as a campus-wide assistant professor of energy and resources. I had an appointment that did not report to any dean or any provost, reported directly to the Office of the Chancellor. And my task was to build interdisciplinary bridges on energy environment development and security across the many departments and schools at Berkeley.

Rob Stavins: I assume that the result of that aspiration was in fact, the Energy and Resources Group. When was that founded?

John Holdren: Well, it took a year and a half from the time I arrived in July of 1973 to get the nine approvals from campus committees and ultimately the legislature's Committee on Post-Secondary Education to offer new degrees, to admit students and to offer our own courses. So the Energy and Resources Group as student-admitting, degree-granting entity started in 1975.

Rob Stavins: I see. I see. Now, you became obviously a very central member of the Berkeley faculty, almost an institution there. It must have been shocking to many when you left Berkeley for Harvard, I believe in 1996. I guess my question is, how did that come about and why did you do it?

John Holdren: Well, first of all, I had a great run at Berkeley. I spent 23 years there. The program was flourishing, the Energy and Resources Group. We had by the time I left graduated several hundred people with master's degrees and PhDs in energy and resources. Virtually all of them were gainfully employed in the areas in which they were trained. So we actually had a better employment record than the Physics Department, the Economics Department, or the Electrical Engineering Department, because there was so much demand for people with interdisciplinary training in energy and environment. So I recognized that I could leave without serious harm to the program. There were many other terrific people there by then, and I had very strong reasons to move. One was I was traveling to Washington D.C. every week to serve both on President Clinton's Committee of Advisors on Science and Technology, and I was chairing for National Academy of Sciences committees at the time.

John Holdren: So I would teach Tuesday, Wednesday, Thursday, and then get on a red eye to Washington D.C. Thursday night. I'd spend Friday, Saturday, Sunday, Monday in Washington, D.C., mostly at the White House and the National Academy, and then I would get back on a plane on Monday night, teach Tuesday, Wednesday, Thursday, and go back again at the end of the week. I did that 13 weeks out of the 15-week academic semester for the last two years I was at Berkeley. And I finally came to the realization that the commute to Washington D.C. is a lot shorter from Cambridge, Massachusetts than it is from Berkeley, California.

Rob Stavins: So we benefited from the location of Harvard it turns out. That's good to know. I want to turn now to policy and there's so much we can talk about, but I want to start just for a moment by going back to early work of yours, which I think is in the early part of the 1970s with the great Paul Erlich, a friend of yours, obviously on population issues. We don't hear about that a lot nowadays. So I think it would be interesting to our listeners to learn what was your core thesis then and how do you reflect on it now?

John Holdren: Well, I started to work with Paul Erlich in the fall of 1968, shortly after he published the book, “The Population Bomb.” And I became acquainted with him because I was talking to my wife over dinner about what I thought was missing

from his analysis. I thought Paul's analysis was basically very sound, but he paid too little attention to the role of science and technology, both as a contributor in some cases to the environmental harm done by a growing global population, but also as a set of solutions to ameliorate some of that harm and enable the world to live more comfortably with the population that it had and was getting. And the result of my conversation with my wife about that was that she persuaded me to write Paul Erlich a letter. He called me up in my cubicle in the Institute for Plasma Research and said, "Come have coffee with me."

John Holdren: The coffee lasted six hours and we had drafted our first paper together at the end of that six hours. That paper was published in 1969 and it was called “Population and Panaceas: A Technological Perspective.” And it basically made the argument that the usual so-called solutions from technology will use desalting seawater to make the oceans bloom, we’ll have cheap nuclear energy for everybody. That those solutions all had limitations and liabilities, and that it was unwise to suppose that the human population could grow without limit with technology always coming to the rescue in time. That was the basic principle.

John Holdren: We subsequently did a lot of work on the contributing factors to environmental and resource issues of various kinds and developed this very elementary proposition that we call IPAT. Impact equals population times affluence times technology, meaning number of people, times economic activity per person, times the technological impact of making that economic activity possible. And the argument was that all of the factors are important. None are unimportant. They are multiplicative so growth in any one of them contributes to the multiplicative product of the three and accelerates harm to the environment. Paul and I actually shared the Volvo International Environment Prize for this rather elementary insight. We used to joke that it was like saying the number of legs is like the number of horses times four. And it's really a very straightforward elaboration of the standard economic insight.

Rob Stavins: Right.

John Holdren: …that economic activity equals the number of people, times economic activity per person.

Rob Stavins: Right. Now I've seen you use, I believe, an expanded form of that identity when teaching a basic session on the science of climate change to some of our students. Isn't that right?

John Holdren: Yeah, absolutely. All one does in that case is you disaggregate the technology term into energy use per unit of economic activity times greenhouse gas emissions per unit of energy use. And the result is an identity for developing the sum of greenhouse gas emissions as a four-way product – population times economic activity per person, times energy per unit of economic activity, times greenhouse gas emissions per unit of energy. And we published that starting I think in about 1974. Again, an absolutely elementary insight, but it got a fair

amount of attention because it was a very easy way to do back-of-the-envelope calculations about the contributions of different factors.

John Holdren: I do want to add that we said from the very beginning, by the way, that these factors are not always independent. We were sometimes accused of ignoring that, but in our very first publication on the topic, we pointed out that very often the level of economic activity determines what technologies are going to be used in order to meet it. And there are many other feedbacks across those different factors.

Rob Stavins: Right. I mean, but even looking at the basic identity, including all that endogeneity, the relationships among them, what it does provide is a wonderful framework for thinking about a complex problem like climate change and for teaching about climate change and climate change policy.

John Holdren: And that's how we used it.

Rob Stavins: Yeah, exactly.

Rob Stavins: Speaking of climate change and policy, I want to turn to your long service in the Obama Administration. I think our listeners would be interested to hear what was the greatest high point for you and what was the most significant low point for you in those eight years in the administration?

John Holdren: Well, I would say the high point was probably President Obama's announcement in June 2013 of his Climate Action Plan, which had been brewing of course throughout the whole time that President Obama was in office. I in fact, had met President Obama and started advising him when he was still a senator. I was invited to meet with him and some other experts on climate change and we hit it off. And so, I started advising him on the issues that became the centerpiece of the Climate Action Plan, actually in 2007. And that certainly, that coming to fruition in June 2013 in the form of the three-part Climate Action Plan – one part reduce domestic emissions, second part increase domestic preparedness, resilience, and adaptation for the changes in climate that can no longer be avoided. And the third piece – assist other countries in both those respects. That was a big moment.

John Holdren: Of course, the achievement of the Paris Agreement in December 2015 was a second big moment. And a third was the president's meeting, President Obama meeting with President Xi in Beijing in November 2014, announcing that the United States and China recognized jointly their large responsibility for global greenhouse gas emissions and their determination to lead on addressing the challenges flowing from that. Those were certainly among the highlights, but I must admit I have a much longer list because I really had a terrific experience working for Obama in the White House for eight years. And there were many different issues, not just climate change…

Rob Stavins: Sure.

John Holdren: ... on which we were able to make some progress. So I had a lot of high points.

John Holdren: The biggest low point I would say is that we were not able to get the budget increases for research and development that President Obama had committed himself to at the very beginning of his administration. He gave a speech to the National Academy of Sciences in April 2009 in which he said we should be aiming to increase national expenditures, both public and private on research and development, to reach 3% of GDP, a level that had never been reached before, although it was approached at the height of the space race in the 1960s. We didn't get there. And that was the single biggest disappointment. We didn't get there, not from lack of interest, but from lack of ability to persuade the Congress to boost those budgets.

Rob Stavins: Right. Now, a number of our other Harvard colleagues served in the Obama Administration with you and in other parts of the government, but I'm not sure that any of them were there as long as you, including our friend and colleague Ash Carter, who went at the beginning and left at the end, but took two years off in the middle to go to Stanford.

John Holdren: Right.

Rob Stavins: My question to you is, after eight years, what was it like to leave that very highly charged atmosphere and then to return to academia?

John Holdren: Well, the first thing that happened is my blood pressure went down by 20 points within two weeks of leaving the White House. That was an extremely rewarding job, but it was a very high-pressure job and it was 24/7/365. That is officially when you're what is called a commissioned officer of the president, you are on duty all the time. You can never be out of touch. You can't go anywhere without having a way for the White House to reach you immediately if the president wants you, and there is such a continuing flow of issues that need your immediate attention, that it really is a very high-pressure environment. I loved it, but the first thing that happened when I left was the onset of a degree of relaxation that I had not experienced for eight years.

Rob Stavins: Well, that's good then.

Rob Stavins: Let's turn to the current world of climate change policy. In terms of climate change policies, what grade do you give the Biden Administration?

John Holdren: Well, it's early, first of all. So it would have to be... It's not even a midterm grade. It's a very preliminary grade.

Rob Stavins: Right.

John Holdren: But I think in terms of what Biden has been doing, I'd give him an A minus at this point. And it's largely on the basis, not just of details of policy as proposed, but people put in place. That is Biden has put together just a superb team. I think it's by far the strongest team on climate change that's ever been assembled in a government. And when asked what's the most important thing in achieving success in science and technology policy in government, or indeed any other domain of government activity, I always answer the single most important thing is people. The single most important thing is having an absolutely top flight team in terms of relevant competencies and their ability and willingness to work seamlessly together. That is what President Biden has put in place.

John Holdren: I have a great deal of confidence in the folks in the White House and the State Department. And the folks in the key positions have firstly, all worked together before. John Kerry and Tony Blinken in the State Department, Gina McCarthy and Eric Lander, Jane Lubchenco in the White House. It's an incredible team. Jake Sullivan, the National Security Advisor, extremely smart, broad individual. I have a lot of confidence that these folks, with the help of a growing number of allies in the Congress, are going to get some of the important things that need to be done, done. And of course, it's very important that the United States is back internationally in the climate leadership.

Rob Stavins: You're speaking about the importance of the individuals, the personnel. If we think more broadly than climate, indeed more broadly than energy and environment and make the contrast with the administration that just left office in January, the Trump Administration, then it's just heartening to see an administration and a White House that actually relies upon the best available scientific and other kinds of real-world evidence.

John Holdren: That's exactly right. When I first met Obama at this dinner in 2007, and we were chatting before the conversation turned to climate change per se. And one of the things Obama said to me about the administration that preceded him, the George W. Bush Administration, he said, "This is the most fact-averse administration that I've ever seen." And of course, the George W. Bush Administration came to be regarded as quite respectable by comparison…

Rob Stavins: Absolutely.

John Holdren: ... with what Trump did. And so the contrast is extremely sharp. Again, the folks who are now in place with Biden, are all folks with whom he's had a long working relationship. And so it's not just that they're great people, but they're people who have already demonstrated that they can work together. They're people who have Biden's respect. They're people who can listen as well as talk. That is paying attention to the views of others that may well be important. And so, again, I'm very optimistic.

Rob Stavins: Sure.

John Holdren: I give it only an A minus because of constraints that are already evident on what they're going to be able to get done, given the current complexion of the Senate.

Rob Stavins: So that optimism is for the current administration and well founded. What I want to ask you about, and I apologize for this, is to make up a longer term prediction and a prediction that draws both upon your tremendous breadth of scientific expertise, as well as your experience in government. And to ask you, where do you think the world will be in let's say 10 or 15 years from now? And I'm thinking of the US, Europe, and of course, China, with regards to climate change policy and action. Not your hope, but your candid expectation.

John Holdren: Oh, that's a really hard question, Rob, as you well know.

Rob Stavins: Yes.

John Holdren: I believe in working for the best and planning for the worst, and I think the best toward which we're working would involve in my judgment, first of all, a very substantial tax on greenhouse gas emissions, escalating over time to provide increasing incentives, both for deploying the best available technologies to ameliorate the drivers of climate change, but also to invest in research and development, to produce the still better technologies that we're going to need in the longer run.

Rob Stavins: And that's your expectation that we will have that over the next 10 to 15 years?

John Holdren: My guess is that we will. I think we will have a significant carbon tax by 2024, but again, I am a congenital optimist and I realized that it won't necessarily happen, but I believe it will. And it will happen for a couple of reasons, one of which is that the impacts of climate change are now so conspicuous that it is becoming impossible for people to, with any credibility at all, deny that this is an immense challenge to well-being on the planet. Look at the temperatures that are being experienced right now, not just across the United States, but across much of the rest of the world. In Siberia, we've got temperatures over 100 degrees. For heaven sakes, temperatures of 112 in Seattle. We're seeing an enormous array of real impacts on human wellbeing already coming from climate change – more powerful storms, longer hotter heat waves, longer dryer droughts, much bigger wildfires, impacts on species that we love, species that we hate, species that we need, all being impacted by climate change.

John Holdren: People are coming to understand in larger and larger numbers, that this is a challenge that society must rise to meet. And I think the deniers and the wafflers are in retreat. And that's one of the reasons I think we will get at least quite a lot of what we need in the next few years.

John Holdren: The most important thing by the way, is what we do in this decade. It's all very interesting to say, where are we going to be in 2050? What is going to be the

global temperature? What are going to be the greenhouse gas concentrations? What are going to be the impacts? But if you look at the nature of the trajectory needed to get from here to there, the single most important thing is not to try to predict exactly where we're going to be in 2050, but to take the steps over the next few years that we need to take in order to position ourselves to get on a trajectory we can live with.

Rob Stavins: Yeah. I agree with that. Whenever I hear either corporate pronouncements or government pronouncements or from advocacy groups of this focus on 2050, my reaction is always, and I've often said is what's going to happen by 2030?

John Holdren: Exactly.

Rob Stavins: What's the plan?

John Holdren: Exactly.

Rob Stavins: Finally, because we're talking about reasons to be optimistic in terms of expectations, one of the reasons I would think, just my own mind, is that it is clear that younger people, the youngest generation... I'll start with the primary school, but then you move on up into high school, et cetera, certainly take climate change vastly more serious than older generations do. It's probably too soon to say whether that's an age effect or a cohort effect, but we notice it. And what I want to ask you about for a final question is what's your personal reaction to these youth movements regarding climate change that were so prominent in both Europe and the United States, particularly in 2019 before the pandemic hit?

John Holdren: Well, first of all, I applaud the youth movements. That doesn't mean that I think they've got every last policy recommendation right, but the enthusiasm, the focus, the energy are a tremendously productive infusion into the system. I mean, my own view is that there are three big reasons for optimism. Two of them we've already mentioned. One is the increasing recognition that climate change is real and dangerous, and that we need to act quickly to minimize the ultimate amount of harm. The second is the energy commitment of the younger generation. And the third is technology is getting better fast. That is we've seen enormous decreases in the cost of solar photovoltaic, electricity generation, tremendous decreases in the cost of wind power generation.

John Holdren: We may see decreases in the cost of carbon capture and sequestration, decreases in the cost of advanced nuclear energy technologies that might be able to make a significant contribution if we do everything right. We are seeing fantastic improvements in battery technology, which is going to make electric vehicles the norm. So those three things together – the increasing recognition of the problem, the activism and energy and commitment of youth, and the improvements in technology, those are the reasons for optimism.

Rob Stavins: Well, that's wonderful because we've come full circle at the end of our conversation here to talk about technology and the fundamentals of physics. So we're going to end with that. Thank you very much, John, for having taken time to join us today.

John Holdren: My pleasure, Rob. Thanks so much for having me.

Rob Stavins: Thanks again to our guest today, John Holdren, long-time professor at both Harvard, and before that at the University of California at Berkeley.

Rob Stavins: Please join us 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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