

EGC Voices in Development, Episode 9: Nick Ryan

Cheney: Why do some countries advance while others fall behind? Who benefits from economic growth and who doesn't? How do inequality and climate change affect people, especially the most marginalized? What role can data play in answering questions like these and informing policies that promote economic justice? Let's find out on voices and development.

Hello and welcome to our podcast. I'm your host, Catherine Cheney. We're coming to you from the Economic Growth Center at Yale University, which is focused on economics and data driven insights for equitable development. Today, we're going to hear from Nick Ryan, an associate professor of economics here at Yale, about his work on energy and emerging markets and how climate change impacts the future of economic development. Nick and colleagues, including Rohini Pande, director of EGC, have worked with policymakers in the state of Gujarat, India, to improve environmental regulation.

Their work could offer a model for other countries seeking new strategies to lower pollution. Nick talks about the trade-offs low-and-middle income countries face between expanding access to energy, while also reducing the health and environmental costs of energy production. He says a critical role that development economists can play in supporting environmentally sustainable economic growth is to generate evidence on the impact different policy changes can have in order to inform decision making. Now on to the conversation. Nick, thanks so much for joining us.

Ryan: Well, thank you for having me.

01:42 – 02:45

Cheney: You have a pretty unique focus on energy markets and environmental regulation. So how did you end up on this path?

Ryan: I went into grad school knowing that I was really interested in economic development for a lot of the reasons many people are. Why are developing countries so much poorer? What are the obstacles to growing rich and adopting technology from rich countries? And I was also interested in studying firms. I had worked at the Federal Reserve, which regulates big banks. I had seen models of firm behavior that seemed to work very well, and there wasn't that much in development that was doing both of these things at once. Even though when you look around, all of the highly developed countries have a lot of big firms that organize a huge amount of economic activity.

Think of the Amazons of the worlds that are growing seemingly without bound. So, you know, that is an integral to the process of development. And those kind of big firms are also hugely important in energy markets. Energy markets are markets where the largest firms compete. So I kind of wanted to try to fuse these things, and that was what caught my interest. And it so happened I had opportunities to work on that.

02:46 - 04:06

Cheney: I know that in graduate school you did some research in India, which of course led to a lot of continued work there. So can you talk more about that and how it influenced you?

Ryan: I had a wonderful time in graduate school, and one of the opportunities I had was to go work in India on a project in environmental regulation, basically under my advisor, Esther Duflo, and Rohini Pande, who at that time was at the Harvard Kennedy School. She's now a colleague at Yale. And that was very interesting. We had a connection to a policymaker in a state which was struggling to enforce

environmental rules, to try to hold factories accountable for the pollution that they put out. And we came in and tried to start thinking about that.

And what turned out was, well, this is just a super hard problem because the regulator doesn't have much information on what firms are polluting or how much would it cost them to clean up. And so, I think the regulators get a lot of heat for the severe pollution problems in developing countries without really a recognition of the difficulty of that problem. And so, we engaged with that as researchers and tried to think of ways that research might suggest to improve things. And that's led to a collaboration, really, of over ten years now, with both that original state regulator and various other environmental regulators around India on trying to improve environmental regulation.

04:06 - 05:31

Cheney: I do want to ask you about what seems to be a big question connecting your research, and that is what the role of energy in economic development is. And I know to you this is very obvious, but for those who aren't as immersed in this topic, why is research around this question so important?

Ryan: It's funny because I don't feel that it's very obvious to economists either.

I think we all have a conviction. And if you studied the Industrial Revolution, maybe a strong conviction that energy just changed everything. Moving from an economy where people were dependent on their own power or on animal power or water power to one dependent on coal and electricity consumption of huge amounts of energy through fossil fuels just made a whole different way of life possible.

But that kind of logic, that gut understanding of energy markets, it's not very easy to capture, partly because people don't spend that much on energy. Once a country develops, it's relatively cheap. And so there's this paradox in economics of the value of a good versus its price. And so a lot of the role of research is in energy, trying to study and understand these markets. How do they provide value in the economy? How do they provide value to people, and how do they enable new and different forms of economic organization? So how do they feed into the productivity of large firms, for example?

05:31 - 07:07

Cheney: Something that comes up in this research quite a bit is low-cost energy use. But I know that you don't always mean just the expense of energy consumption. You also mean other costs like health and environmental costs. So I wonder if you can expand on that.

Ryan: The distinction that's important to economists is between the kind of costs that show up on your bill. You know, you get an electric bill every month, or you have a bill from your supplier of fuels, or you pay at the pump of the gas station. We call that the private cost. That's the cost that you as the user of energy, have to pay. And then there's another cost that society pays, which is the cost of the pollution coming out of your tailpipe, or the pollution from the generating plant that's supplying your electricity, or the environmental harm that was a consequence of mining the fossil fuels that generated that electricity, for example.

So, all of those other costs that we don't often see, and this distinction is really important because people just base their own decisions on the costs that are visible to them. But as social or economic or policy thinkers, we want to say, well, what are all of the costs to society, including the second kind? And so there's a huge branch of literature, economics trying to measure those costs, trying to find out in what situations are they higher or lower, and trying to suggest ways that policy might mediate and reduce this gap between the decisions that people are making on their own versus the ones that might be best for them to make from a societal point of view.

And so that's the role of regulation, institutions that try to bring these costs into people's minds when they're making these decisions.

07:07 – 9:31

Cheney: I wonder if you can expand on why these institutions you describe are particularly important in low- and middle-income countries. Take us into what these costs look like, say, in India for people and their way of life. And why does that make finding answers to these questions so critical in these contexts?

Ryan: The first reason it's especially important in developing countries is that the costs are just that much higher and more severe, and I think it helps to put a number on it. In the United States, there's been a lot of regulation of fine particulate matter, dust that gets into your lungs, and that causes a lot of harm for older people, even for younger people. And there have been regulations and debates about what should be the appropriate level for dust. And I won't get into the units, but say dust is measured at 5 or 10. And the question for the Environmental Protection Agency is ten a stringent enough standard, or should it be five, or should it be even lower than five? And then I'm working in India and in many of the cities in India, the level of that same dust measure will be 90 or 100.

What that means when you step off a plane or step off a train, is that it's quite thick and hazy. Famous buildings like the Taj Mahal become tarnished by soot and by these consequences and pollution. It's really remarkable. You know, people get used to living in many conditions, and it seems usual. But from the perspective of developed countries and most of world history, it's very unusual that you should be subject to pollution that's so severe. And then the second reason why this is especially important for low-income countries is that they've not got all of the energy that they should from the course of economic development.

In the US system, people have a pretty abundant access to modern energy sources. It's reliable, it's cheap, it's low in private cost. But in developing countries that's not true. And so many people are just getting access to electricity for the first time. And there's therefore a much sharper tradeoff between the kind of social and environmental costs I was describing and the social reality of wanting to connect more people to energy and use more energy, even though that energy is what's causing these environmental harms.

So that makes the public policy tradeoff between the environment and economic growth just that much sharper.

09:31 – 11:11

Cheney: This gets to a tension that often comes up in addressing climate change. Low-income countries who are the most vulnerable to the consequences, have done the least to cause the problem. And yet they're being asked to make changes. So when it comes to this question of equitably distributing the cost of reducing emissions, where do you come at that debate based on your research?

Ryan: These are very difficult questions. If you looked at the proceedings in. Most recent conference of the parties in Egypt. It was almost all about or devoted mainly to this question of what should be the division of responsibility for climate change, and also should there be climate reparations paid to lower income countries because of what you mentioned, that they've not been responsible for the majority of historic emissions, and yet they're being impacted more by climate change. As an economist, I don't feel that I have a deeper moral, ethical insight into these kinds of questions.

I think everyone is weighing the same ethical questions, but what I think research can do is articulate well, what are the tradeoffs needed? For example, if you were to clean up the electricity sector in lower income countries, to move away from capacity in coal fired power plants and use only renewable energy

in electricity generation, how much would that cost, and how much of that cost would be borne by local governments? How much of that could be recouped by such payments? So really, to articulate what is possible with different kind of policy changes, rather than to make a choice as to which of those policy changes is the most desirable, about which many reasonable people could disagree, and the countries of the world will continue to debate.

11:18 – 13:51

Cheney: I know one thing you've looked into is, as you mentioned, renewable energy and specifically solar power. So I want to talk about a recent paper, demand for electricity on the global electrification frontier. And it's looking at how households in different contexts choose between sources of electricity. So what did you find?

Ryan: This is a paper joint with Robin Burgess at LSE, Michael Greenstone at [University of] Chicago, and Anant Sudarshan at Warwick. And what we were studying was when households have a choice between different kinds of electricity, what do they pick and why? And to say kinds of electricity is weird because electricity is the same. It's the same wherever it is. It's just electrons being pushed through a wire. But now in many poor countries, people do have a choice in how that's delivered and where they get their electricity from.

So, for example, you might plug in to the electricity grid which the government has built or is supporting, or you might just opt out and buy a solar system on your own. In principle, you always could have done that. You could have set up your own little power plant or diesel generator in your backyard. But until solar power came along, that was impractical. Expensive. But what we see now is that in many of the places where people don't have electricity from the grid, solar has taken off as a really popular option.

So in Mali, like 60% of the households have a solar system. In Uganda, in Tanzania, it's above 40%. And so that was viewed as a very serious choice. And we wanted to understand how our households making that trade off. So to do that, we collected a bunch of data in the state of Bihar in India on as the grid arrived and as solar got cheaper, what did households choose to purchase and why? And we're especially interested in how sensitive they are to the cost of these different options and to their reliability.

Because in a poor country like India, you shouldn't think that the grid arrives and it's running 24/7, the supply is perfectly reliable and so forth. Rather, it's quite patchy. There are many outages and so it's not as obviously appealing as it might be in the United States. And what we find is that, consistent with this view, households are actually glad to get solar power because it's pretty cheap, so it makes them much better off than they were before when they were sitting waiting in their village with no grid connectivity. But when the grid does arrive, that tends to push the solar systems out.

And in India, the reason for that is in part the government is subsidizing the energy on the grid. So it's super cheap. It's even cheaper than these small-scale solar systems that many households could buy for themselves.

13:51 – 16:18

Cheney: I want to ask you about other work you alluded to earlier. You mentioned it's a decade in the making. I believe this is the work around pollution markets. Can pollution markets work in developing countries? Can you tell us more about that work and connect it back to your early work in graduate school? What's happened since and where are you now? With this.

Ryan: I'll spare you the entire detailed history. You know, just to give a brief connection. So, in that prior work that I mentioned, we were studying how the regulator could hopefully lower pollution within the existing set of rules and the system that they were working in. And that system had a lot of gaps or

constraints. You basically had to just measure pollution a few times a year, and then use that to judge how much a plant should be penalized, whether they're meeting pollution standards and so forth.

This is like the arbitrary nature of being caught in a speed trap on a highway. You could drive for years on the highway and never see a police officer, and then two times in a holiday weekend get pulled over for going 67. So, the same kind of unevenness seemed to apply in a lot of the enforcement of the existing regulations. And we thought that one way that this had been addressed in many countries, in the United States and Europe, had been to use pollution markets where the market provides a much steadier, smaller, but reliable incentive to reduce pollution.

And so that would be a goal that was worth working towards. That was the goal, the vision and the regulator we're working with shared this vision, but it was a long way from here to there. As far as thinking about practically, could a pollution market be set up? And one of the reasons is first, one needs to measure all of the pollution coming from all of the sources, the factories that might be regulated under that market, and then set up rules for trading for who has to buy permits and how many permits they have to buy, how are the permits given off or sold off to the firms? So, all of these kinds of details were totally new, because this way of regulating wasn't used in India at the time.

We worked with the regulator, the State Pollution Control Board in Gujarat, to help develop those rules and then implement them in a new market for dust pollution. And this has been like a long journey, but the market has now been up and running for somewhat over two years, and it's been quite successful in reducing pollution at a reasonable cost to the industrial plants involved.

16:18 – 17:34

Cheney: One topic that comes up in a lot of our conversations on voices and development is the importance of bridging that research policy divide and working with policymakers. You've been working very closely with the state of Gujarat on this, and I wonder if you can share any emerging lessons about what has worked in bridging that divide. It really seems from the start that's been the goal of this project.

Ryan: I think the most important thing would be that researchers sort of be open to what are the problems that people actually face in implementing a policy and conscious of those, and try to not just impose some abstract idea from the outside, but really have a genuine collaboration and dialogue. So, for example, in the case of this pollution market, we started working at a time when the monitoring infrastructure for monitoring pollution wasn't even in place. And so, it was impractical to think that pollution market could be started.

But Anant Sudarshan, who's on our research team, and the rest of us helped to develop standards for this pollution monitoring. And the market could then be layered on top of those. So that was just an example of meeting the capacity of the partner where they are, rather than trying something that was beyond their capability or which was inappropriate in a given situation.

17:34 – 18:57

Cheney: This definitely seems like a project policymakers in India and beyond will be paying close attention to. And why do you think that is?

Ryan: Oh gee, I would hope that it's a kind of proof of concept that you can lower pollution, and the cost isn't so great. I think going in we had different perceptions of what we might find. One would be that, well, it's just genuinely hard to lower pollution because it's an inextricable part of development, industrialization, of having a highly successful industrial economy, which Gujarat does and which has created a lot of jobs for people from many states of India versus, well, maybe it's not that hard to lower pollution.

And you can keep a lot of the good things from this development process without necessarily having the same social costs of pollution, which we were talking about before, attendant to energy consumption. And so, if anything, what we've learned from this be a little bit hopeful. So that's the good part. The more difficult part is that it's not an easy formula. There's a huge amount of work that the regulator put in and our team and the commodity exchange that runs the market. There's a kind of portable lesson in there about what to aspire to, but it's still takes a lot of work to make a market work basically anywhere. So, it's a portable lesson, but doesn't make it simple to replicate necessarily.

18:57 – 20:23

Cheney: I know you've described this moment we were in as we're at the cusp of this new way of powering the economy, but there's the technical promise, and then there's the economic side of it. Where does economics come in at this potentially exciting moment?

Ryan: There's been just huge technological progress for renewable energy generation, for solar and for wind especially. And now to an extent for battery storage, for electric vehicles and so forth. And so, these things are starting to ripple out through the economy in developed economies and then in developing economies as well. Now, the reason why that's an interesting start, but we're just at the start or at the cusp is that you might think, oh, well, once a technology gets cheaper, if I can generate solar power at \$0.02 a kilowatt hour and coal used to be \$0.03 a kilowatt hour, now that should just spread everywhere overnight.

But that's of course, not at all the case. There are many reasons why it will be complicated and difficult to move to a new technology. And so, understanding how markets respond to this, to the incentives and opportunities created by cheaper renewable power, is really the work, I think, of a whole generation in the private sector, in academia and governments to anticipate, to study the consequences of this change and to alter policies and policy rules, to try to make it go easier for more people and to bring cheaper energy to more people more quickly.

20:24 – 22:25

Cheney: As you've noted, in order to support these clean energy transitions, especially in low- and middle-income countries, you need not just the technologies you said, but the regulations, the institutions, the policies, and your work is starting to uncover some of what is needed. But anything more to say about why more focus on regulations, institutions and policies is needed and what you see as continued work in this space that needs to happen?

Ryan: The place we should be putting a lot of economic thinking is in the markets that work badly. Some markets work very badly when left on their own. Health care markets tend to work badly. Energy markets tend to work badly because they have these environmental consequences and firms accumulate too much power. And so those are areas where we can have a lot of value in trying to advise on policies, study the effects of policies that have been put out in the past and suggest new directions. So, one example that I'm involved in, in studying the Indian electricity market and how to get more renewable energy into that market.

And this is an interesting case because India has been adding a huge amount of renewable energy to meet their goals under the Paris Climate accord, but still struggling to keep pace with those goals and struggling to integrate this new energy into the grid. And I have work looking at how you buy new solar power and whether the price of that solar power and the level of investment depends on the risk that the project developers face. So, this is like an element that's specific to the Indian market, that there's a high level of project development risk, because, for example, you might not be paid on time for the power that you deliver.

And then study how that filters through to the addition of new renewable energy in the market. So, this is an example of an institution that might seem niche, which is what kind of contracts do you sign? Who enforces those contracts for new power, but will ultimately determine whether India is able to continue making that rapid progress towards its international climate goals.

22:35 – 24:06

Cheney: You've described a goal of your research as grounding energy and environmental economics in how governments and markets actually work in developing countries. So, what do you mean by that? And maybe you can share some surprises from along the way.

Ryan: The main thing, I mean is to get out of the textbook and get into the differences between what we might assume to happen and what actually happens. So, for example, we were talking about pollution markets in the textbook. A pollution market is always a good thing because it lowers the cost of meeting a given level of pollution in the actual reality. It might be that a pollution market is a good thing, but it might be very difficult to implement or impossible to enforce, and it might fall apart.

And so, you want to try that out. Or like in the case I was describing with renewable energy, you might say that, oh, well, the choice between different modes of electricity. We don't think households have to worry about that because really, you're going to plug in solar power on the grid, or you're going to plug in coal-fired power plant. And the experience of the end user, the consumer household is the same. Well, that's not the case in many developing countries because they're not choosing between different technologies on the grid. They're choosing whether to be on the grid and pay to be on the grid or not be on the grid at all.

The choices that people are making, or the choices that firms are facing, could be very different from how we would conceptualize them, set them up when just thinking in very abstract terms.

24:06 – 25:42

Cheney: So, Nick, in all of these questions you've been asking and research you've been conducting, why is development economics an interesting tool to approach these big questions?

Nick: One of the things that development economics does amazingly well is try to get a sense of what's actually happening and connect to people's experience and the experience of governments, and to work with policymakers or firms or regulators and see the problems that they're facing, rather than the problems that we envision that they might face.

And I think that is really powerful because grounds what you're doing. There's a concern in academia that people can wander off in circles and whole fields, could spend decades chasing their own tails. But development economists, I think, do a great job of collecting data and disciplining the research they do by people's actual experience. I think this is especially important for energy and environmental issues, because things are changing very quickly, and the textbooks have a lot of ideas about how regulation ought to be done, which just plainly are not being implemented. Sometimes, not at all, sometimes to a lesser extent than we would expect.

I think that that feedback of checking your ideas against actual markets, how they're working, how firms are behaving, how households are choosing is super valuable. And make sure to keep you honest and focusing on things that are important.

25:42 – 27:31

Cheney: I wonder if you can give us a preview of some things you're working on right now, as well as some of the questions you hope to tackle moving forward.

Ryan: One of the things that I'm working on now is a project about carbon offsets in China. This is an idea and not yet a paper, but I think it could be interesting and impactful. The motivation here is that there's huge differences across different countries in the extent to which they're reducing emissions or trying to reduce emissions. And you would like, for the reasons of equity we discussed before, or also for reasons of efficiency, that there could be a mechanism to transfer emissions across countries.

So, if you're in the United States and somebody else is in India or China or in the Philippines, you'd like to say, well, could I pay a bit more for my energy in exchange that you should reduce carbon emissions elsewhere? And could such a trade exist that would make both parties better off? So, this has been part of the rules of many international climate agreements, but people still aren't really confident that these kinds of offset payments work. You're offered to buy offsets even when you buy a plane ticket. Now, if you're thinking clearly, you should be a little bit skeptical about those.

What we're trying to do in this project is to measure whether such offsets have actually been successful in reducing emissions, and to see how much they cost and whether that mechanism, that rule of using offsets to pay for reductions elsewhere, is generally reliable. And I won't spoil things by giving away any results. But I think it's going to be an area which is increasingly important in climate policy going forward. As these negotiations get down to exactly what is the cost responsibility and where can emissions be reduced to meet any given country's target.

27:31 – 28:49

Cheney: And in terms of other big questions in this space, either that you hope to tackle or you would like to see others in development economics or research more broadly tackle. What are some of those big questions?

Ryan: Well, we've touched on a few, and I would say that the few we've touched, there are many that are still quite open. So, I touched on the idea that the costs of reducing emissions of particulate matter is pretty low. Is that really true? Is that insight portable? If so, how could you do this in different situations? Could you also do this in transportation? What are the options for reducing emissions in transportation when electric vehicles are coming to developing countries as well? I think another line of inquiry, which I'm very interested in, is how our electricity systems in poor countries going to respond to massive levels of renewable energy penetration, which have till now hardly been seen anywhere.

And in many developing countries, the electricity grid doesn't work perfectly well now. It's not very reliable. It might be higher cost and it's going to come under a lot of strain when a lot of solar and wind capacity comes on. So how will that be dealt with? What changes need to be made to market designs, rules, prices and so forth, so that that experience improves the energy supply for poor countries?

28:50 – 31:12

Cheney: Nick, I know that when you work on these topics, you are picturing real people and how they are really impacted from the household level to the halls of policy. But for those who don't see this work and its impact day in and day out, can you just share a few stories about the stakes of what you're working on for?

Ryan: For many people have traveled in developing countries, they've seen a bit of energy poverty and also seeing the consequences of pollution. During graduate school, I stayed in Ahmedabad, which is near the capital. It's the commercial capital of Gujarat, which is the state that we've been working with for improvements in environmental regulation. And that city, like many Indian cities, is very polluted. And because it was developed earlier than other Indian cities, a lot of the industrial activity is very close to the center of the city.

So, if you're living there, staying there, sleeping there, you can smell the pollution wafting across the river from the factories nearby. And that sticks with you a little bit. And now one of the exciting aspects of this pollution market, having done well where it started, which is in another city called Surat, is that there's a prospect that will expand to Ahmedabad as well. And so, in that case, I would hope that it might push down some of that pollution that one could smell and make the residents there, their children a little bit healthier, a little bit better off.

And that's the kind of connection that you hope to make. The research on health effects of pollution says, well, people should benefit a great deal if these factories are able to. Keep producing, but turn down the external cost of that production by some extent.

Cheney: Nick, thank you so much for joining us.

Ryan: Thanks so much for having me.

Cheney: That's all we have time for in this episode of Voices in Development. If you'd like to learn more about the Economic Growth Center, you can visit the website at Yale Edu. There you can also access details on the Yale Climate, environment, and Economic Growth Conference, featuring Nick Ryan and other researchers working on environmentally sustainable economic growth, and look for the next installment of Voices in Development on website or on Apple Podcasts, Spotify, or wherever you get your podcasts.