

GTH_S2 Ep 3_Innovation in Energy

Ed Morse & Amy Jaffe

Jorian Murray (00:07)

Science tells us that we need to control global temperature to no more than 1.5% of pre-industrial levels if we're to protect our planet for the long term. Earth is already more than 1% warmer than the 1800s, and emissions continue to rise. This is why the agreement reached at the United Nations Climate Change Conference in Paris in December 2015 to reduce greenhouse gases was so historic and important. The move to a carbon neutral or net zero world is much easier said than done. It requires a total transition in the way we use energy. Today, on Good Things Happen, we're going to assess how the world is doing seven years after the Paris Agreement.

And to help answer this question, we have Amy Jaffe, Managing Director of the Climate Policy Lab at Tufts University, Fletcher School of Law and Diplomacy, and Dr. Edward Morse, who sits as Global Head of Commodity Research. Amy, Ed, welcome. Thank you so much for joining us today. Um, I always like to start our podcast by learning a little bit about your stories and how you got to do the, I mean, in your case, not only fascinating but critical work that you do. Amy, tell us where did it all start for you, from university?

Amy Jaffe (01:21)

Well, you know, I had a very circuitous journey. I actually studied Arabic and the history of the Middle East when I was at university. And that led me to a career as a financial journalist, where I got assigned to write about oil, as a commodity. Incredible market, highly geopolitical, took me all around the world. And then, in a sort of crook of fate my husband actually needed to move to Houston and I wound up, accidentally, in a position at Rice University because they were starting a public policy institute, and they needed someone to help them with an assignment to assess the future of the Middle East and how it would affect the oil commodity market. And from that, morphed into becoming a professor, helping Rice build a sustainability practice in its curriculum across the sciences, public policy, and the business school.

And then my journey kind of went more and more down the path to thinking about decarbonization, because that's so critically important. So went to California to work with the state on pathways for transportation fuels. Again, bizarre things took place that led to a series of coincidences, and I wound up being the chief advisor to the University of California pension fund, a \$140 billion pension and endowment fund, helping them develop a climate risk and environmental, social, and governance strategy for their investment practice.

At a complicated financial institution like the UC pension and endowment funds, that involved looking at things like what are we doing in the real assets, so what hard assets is the university investing in? What do they hold in the bond market? How do they think through real estate investments? So that was a real sort of professor of practice assignment in the real world, where we would make a decision and I would have to come in and see, did we make the right investment, which we did make a lot of very good choices at that time. And since then, I've been working steadily on the subject of climate risk and how it affects financial markets.

Jorian Murray (03:32)

Amazing. Almost every time I ask guests that, they often use the word "accident" and they're probably more surprised that they've ended up doing what they do considering where they started. How about you, Ed? Has your career been a straight line or have there been a few meanders?

Ed Morse (03:46)

No, it's been meandering, even before the career started, since I never knew what I wanted to do when I grew up until I grew up. It's all accidental. It's the nature of the world we live in. You look at opportunities and options and they put you in one direction or another. I happened to have been very confused about what I wanted to do in life. I have three different Master's degrees in three different fields. I finally got an even further advanced degree in something I thought I wanted to do and then I ended up teaching. I actually was not thinking about teaching anything related to commodities, but I was more interested in finance and the monetary system.

And while teaching the Arab oil embargo occurred, and I couldn't teach without considering the Arab oil embargo. And then I got into by accident, writing a paper with the head of the New York Fed, and we got to work on petrodollar recycling. Petrodollar recycling got me into a lot of other things, so I went from a teaching job to a think tank job to a government job. And when I was in the government in the Carter and Reagan administrations, I was assigned to be the most senior person in the State Department whose full-time job was energy.

And, as I said, I didn't start out looking at energy. I started getting involved with resources for the future. I went to work for an oil company. I left that and started a consulting company with somebody else. I got into the publishing business. Amy actually worked in that publishing company for a while. After that, I sold the company and decided to work for a hedge fund and then I decided to do what I said I would never do in my life, work for a bank.

And the bank that I started to work for told me that I could do what I dreamed of doing at a bank, which I could no longer do at a bank because regulations have changed, I actually created the commodity research teams - The three major banks had never had any. Each of the first two disbanded their commodity program, but the third one, which I am now at, did not, and it's a flourishing program. When you're in commodities and you see things happening in the carbon-related world, you have to get involved in it. And certainly, once carbon started being traded and priced, which is really, critically, at the heart of the energy transition, and the energy transition would be a lot smoother if the world could figure out how to price carbon. It does it obliquely, rather than directly, but here I am running a research program that has people involved in the carbon markets, and I have to get involved in it myself.

Jorian Murray (06:05)

Well, we are blessed today. We are gonna be discussing energy transition and both your circuitous, accidental stories... It sounds like everything either of you have done is gonna help inform us. So energy transition...I guess, ever since man discovered fire, surely energy transition has been a consistent but bring to life why it's so important now that there is change. Amy?

Amy Jaffe (06:30):

You know, we're at a critical juncture. You mentioned the global Paris Accord. At Glasgow meetings for the climate last year, we did kind of get on track so we have more ambitious commitments from countries, but those will only take us to 2.5 degrees warming if everybody met what they promised to do, so we really need to speed up. And we need to deepen our activity, and that is going to a rapid changeover of infrastructure, which we're not seeing.

And so, here in the academic world, we have a new terminology. We call it the mid-transition. What that really means is we haven't retired the old system well enough to abandon it and the new system isn't integrated well enough with the old system, so we get the discontinuities like we're seeing in geopolitics and too many retirements of what... you know, coal plants before we have new solutions for storage,

with new electricity. And so we're kind of in the interim period where we really need to speed up to meet the 1.5 degrees target, and we're having this sort of bumpy road, where we have to focus on both maintaining the old system and building out the new system.

Jorian Murray (07:44):

Ed, before we get into the nitty gritty and what are the challenges that we're facing, can you give us a kind of broader view of what the problem is that we're trying solve? I think when we met once before, you talked about our addiction to fossil fuels. Put that into perspective for us, please.

Ed Morse (08:01):

Sure. Building on what Amy said, we've had economic model of growth in the world for the last 140, 150 years, which is totally dependent on the availability of inexpensive fossil fuels. And now, the world has decided, by consensus, not by mandate but consensus, as Amy said, at the Paris meeting, that in the next 30 years, we're gonna undo all of that. So, getting off of carbon and getting off of fossil fuels, which is critical to the transition in eliminating already emitted carbon dioxide and methane from the environment, from the atmosphere, is a very difficult task. It is a radical, revolutionary task. And it is a extremely difficult and bumpy road to move from one model of growth to something totally different.

Amy Jaffe (08:52):

Building on what Ed's saying, one of the new concepts that's being developed in key economies, like India, is this idea of green industrialization, so how do I convert my future economic growth and the generation of jobs for millions of people through the deployment of low-carbon energy and new infrastructure? And important governments, like India, like South Africa, are starting to tackle this absolutely critical challenge. And of course, we've seen China move rapidly in that direction. The level of deployment of renewable energy in China is just stunning in its scale and scope. And you know, how do we accelerate this not only in these countries that are sort of leading in green industrialization but to bring that, uh, path and finance that's needed, um, to developing Africa and to, um, Southeast Asia and other countries?

Jorian Murray (09:48):

I read somewhere that the top three greenhouse gas emitters are responsible for significantly over 40% of emissions. Does this concentration enhance our chances of success or not?

Amy Jaffe (10:00):

Well, some of the challenge gets to be, how do we marry together new technologies in a way that they are reliable and as affordable as the system we've previously been using? So, one of the big challenges has been to retire coal fire generation. In the United States, that retirement has sort of happened naturally, partly because we had such a boom in the development of natural gas, but with some government intervention in 2009 with the stimulus, a huge boon in installation of utility scale, solar and wind, which we're now gonna accelerate yet, again through the new IRA legislation in the Inflation Reduction Act. And we're gonna add offshore wind, and we're gonna add hydrogen hubs. So, the United States emissions actually peaked in 2005, 2006, and we're trying to actively accelerate the trajectory, but of course, we have such a carbon intensive economy. But for countries like China and India, where coal fire generation is not only a big employer of citizens in the country, but also a mainstay of the electricity network in that country and steel manufacturing and so forth. You know, the retirement of coal is really, I think, a big challenge.

Jorian Murray (11:28):

Ed, what are your observations on that?

Ed Morse (11:30):

I would note that the three areas of the world, the three largest economies in the world, the European Union, the United States, and China, have in a year of challenges, namely, this year, with the aftermath of the Russia/Ukraine crisis and the increase in interest rates and the increase in the value of the dollar, slowed down so much of the momentum that had been built through COP26, that we're now seeing in these three large economies, um, really big momentum. We're seeing the, the adoption of policies, Amy mentioned the IRA bill in the US, which followed on the heels of the infrastructure bill, just a half a year before, which are just really radical in leveraging whatever the government can do to lever a private sector capital to come in to make the kinds of investments that have to be made.

And similarly, the European Union, accelerated adopted modified their Fit For 55 program that they had adopted in 2021, as a result of Russia/Ukraine crisis and are accelerating in many areas what they were already building. Their most recent announcement is a new three billion euro hydrogen bank to lever government finance support to what has to be done, namely, getting the supply side and the demand side, which are out of balance, building a bridge across the two of them, so there could be an acceleration of the employment of private capital in moving toward a hydrogen-based economy.

And China adopted a new plan through 2035, focusing in part on hydrogen, but also on building on its technological and infrastructure activity, which has, as Amy said, put it in a leadership position in the world. So the three largest economies are actually accelerating what they've been doing, and are getting almost close enough to be spending enough money on, on, unfolding, uh, the kind of infrastructure that needs to be done.

I'd say that the bad news of this was that with those one or two steps forward, there were one or two steps back, because of, in part, the nature of, what I call the first crisis of the energy transition, that had occurred in 2021, when we saw a world that had moved too quickly in a way to get rid of fossil fuels. So, we had the three largest economies in the world, again, running into trouble, one way or another, because they did not think thoroughly about having in their electric power grid reliability, resilience and redundancy, and in particular, they forgot about the redundancy. And when the wind stopped blowing in Europe, and when we had droughts in North America, China, and Europe in 2021, and 2022, they had to go back to rely more on fossil fuels. So we've seen an increase in fossil fuel use because of this crisis of the energy transition and factors related to dealing with delivering low enough cost electricity to the public that the public would be happy.

Jorian Murray (14:25):

So, it's, it's gratifying to, to see here there's progress of the strongest nations, but maybe or the strongest economies, I should say, um, but maybe that's no surprise. It must seem terribly unfair for emerging markets that really the onus has been put on them. How can the world help them, and is the world helping them, Amy?

Amy Jaffe (14:43):

Well, of course, we have this pledge to provide a hundred billion dollars a year in financial transfers to help with climate adaptation and climate mitigation. So, funding renewable energy in the developing world and, um, helping, uh, countries build capacity. The problem we're facing today is that the climate is not waiting for us to deploy that capital. So not only have we really not met those obligations in terms of the dollars actually being offered and spent. But a lot of the money now has to go towards responding to crises like the flooding in Pakistan or you know, the recent droughts that have disrupted food production.

I recently did an assessment using my students, who are amazing, for the UN Economic Commission for Africa. Looking at what are Africa's needs and there hadn't been a full coalition of all the nationally determined assessments since 2017. And we found that the numbers have risen significantly by hundreds of billions of dollars. People had been working with these 2017 numbers, but the new numbers for what's needed, both in terms of resilience and in terms of you know, this transition for mitigation.

And indeed, I think the tension is now from the developing world side, and it's not a coincidence that we're having the global climate meetings in Egypt, which is on the African continent, and you're gonna have more focus on what has been done, what needs to be done to help the developing world in terms of raising finance, because they really are a small piece of today's global emissions. We're talking about single digit contribution. And so how are we gonna come up with a fair and just solution where we get every country on the right trajectory?

We have enough finance to help people cope with rising temperatures, sea level rise, flooding and scarcity of water. How are we gonna pay for all of that, at the same time helping to move a global scale of the energy system to new fuels?

Jorian Murray (17:04):

Good questions and who's gonna (laughs) answer these questions? And how do we start to answer these questions? They feel almost insurmountable, but where does the process start, Ed?

Ed Morse (17:13):

Well, the process has to start in multiple places. Just thinking about spending. Mackenzie has estimated that getting to the goal of net zero carbon require some 160 to \$170 trillion of spending over the next 30 years. And the spending that we've had, has not only not been between six and seven trillion a year, but has been significantly lower than that for the world as a whole, and even for the US where you'd expect a trillion dollars of spending, were not anywhere close to that. So, it's not just the gap in terms of bridging the inequalities that have existed between emerging markets and advanced economies, but getting to where we need to get.

So undoubtedly, the world needs inventive new ways and new institutions to harness capital. And, this is kind of risky business and in uncharted territory based on a lot of technologies that need to be developed that are not yet in existence. One major way of facilitating the amount of capital spend that's required, and particularly with reference to emerging markets, is through changing the nature of development banks that are multilateral in nature, where rich countries provide the capital and poor countries get to use the capital. We have ourselves proposed that there be a new special multilateral bank, whose sole purpose is energy transition spending.

And the theory behind it is that when you are doing this bridge building between supply and demand gaps, you need public authorities to be involved, to reduce the risk of the entire project and by changing the profile of the risk inducing the private sector to spend more money and invest that capital that's required.

So, it's one small step, but it's indicative of the rethinking that needs to be done. Another part of the rethinking that we think needs to be done and is controversial in many sectors is not just a move to renewable, which we think the world isn't ready for, and the reason the world isn't ready for is that renewable energy, almost by definition is interruptible. And it needs some non-interruptible supply behind it. That non interruptible supply, at least, for today's environment where we don't have battery powers that can last more than 20 hours or so, let alone 20 or 40 days, which you might need in case, of a drought, in order to get from here to there, we need cleaner energy and that cleaner energy can most certainly come more from natural gas than from either oil or coal in particular.

So, we need to find a way to facilitate a transition on natural gas use. And there in particular, you need something like a guarantee from a multilateral lender to enable the LNG, which can be created in an emerging market country or a highly developed country like the United States, well-endowed in natural

gas and now the world's largest producer of natural gas. You can get a way to move that gas to an emerging market country if you have those kinds of guarantees provided by multilateral institutions. So, I think it's a need is to broaden what the risks are in the energy transition and understanding what those risks are and understanding what the needs are for cleaner fossil fuels and finding ways to assure that they'll also be there.

Amy Jaffe (20:44):

Let me weigh in here, because, you know, in the perfect world we would have a natural gas system that doesn't leech methane into the atmosphere, which is a greenhouse gas that's 35 times more potent than carbon dioxide. But that is not the world we live in, and most LNG facilities in the world today have not been designed to prevent methane from leaking out. Throughout the system, US production is still very methane intensive. Russian production is horrifically methane intensive.

So, to have natural gas be a solution, we would need both the industry to step up to the plate and really capture their methane leaks, which we have the technology to do but we don't seem to have the will to do. And we would need to have invested in the kinds of monitoring technology which we're starting to have by satellite and equipment repair at a rapid pace, in addition to adding carbon sequestration to the end use.

So, you know, all of these things are difficult, and Jorian, you asked me at the beginning about my journey. When I was in my different professorial roles, you know, it's very popular among today's students to want to do what we call a practicum, which is we're studying something in the classroom and then we go out into the real world and try to apply our knowledge to helping others. And so I've had many years where I've taken students that have studied sustainability and we've actually gone to Africa, for the summer and tried to work in villages or in communities, bringing about solutions to water shortage or the need for energy. There's a big geopolitical controversy about whether natural gas is or isn't a solution for energy access in Africa. In other words, should we be green-lighting more natural gas pipelines inside Africa? And let me point out the following two things. Number one, even in countries that have a lot of natural gas in Africa, say in West Africa, it's not economically feasible to bring that power generation to these remote and local populations. And so renewable energy, in addition to perhaps utilizing battery storage or pumped air or pumped water or even just developing the massive hydro resources we have on the African continent, these are gonna be much better solutions to really solving the inequities that we have a vast swatch of population in Africa that do not have modern solutions to energy and are still burning wood or still using traditional biomass, or basically going without.

And so, the focus on the geographical solution that matches the needs in different locations, and I believe, from my own work on the ground, that renewable energy is more flexible, can be installed faster, and with advances in planning, can be more reliable than, often, the traditional solutions. And let me just say the following thing. If an extreme weather event happens and it damages a thermal coal plant or it damages a thermal natural gas generation plant, the repair for that plant can take months if not years, and building a new one, same thing. Installing a new LNG facility, we're talking about three to five years, right?

Whereas these companies that do utility scale solar and then toss a battery on it, they can do that in a week. And we've seen that in Puerto Rico and other places where suddenly there's an emergency and we have to have power generation for a hospital or for emergency workers. And we're going to renewable. So, we have to think more creatively about how to build out the future system in ways that make sense, and there might be some places where having natural gas with no methane leakage and with CCS can make economic sense and that community is wealthy enough to put together that solution. But it isn't the one size fits all paradigm and we really build in the potential of renewable energy, of deep offshore wind. Take a country like Vietnam, some of the countries on the coastal countries of Africa, offshore wind is actually probably a more viable and sustainable solution than trying to bring LNG.

Ed Morse (25:23):

I don't disagree with that at all. Where I do disagree to a considerable extent is ignoring the way cleaner energy can be brought into the system. And we know that the IRA bill has in it disincentives to methane leakage. We know that public relations and advertising, who's leaking how much methane also has an impact. There are ways of dealing with it that we are dealing with in the world with new regulations on liquefaction, new regulations absolutely on the tanker fleet that prevents the boil-off from going into the atmosphere, and new regulation at the end user place.

And by the way, on methane emissions, we have natural methane emissions and unnatural ones. The natural ones are pretty big. But if we look at the whole supply chain, we have emissions at the wellhead, we have emissions in the pipeline system, we have emissions at the end user. Emissions in New York City or Boston or Los Angeles are pretty high, and we are doing that in the US now in some of our major cities, including New York, penalizing you if you are leaking methane at the end use, even if it's in the burner stove in your household oven, or if it's in the pipe coming into your apartment building.

So, I think we should not kid ourselves. The energy transition cannot be solved in a smooth path without greater reliance on natural gas. And the good news is there are ways to clean up the lethal nature of methane and methane leakage, but I'm afraid to say that if we try to go directly to renewables, no matter what the renewable is, if you don't have enough storage and the scalability of the storage, which the world is unlikely to have for at least another decade, then people are gonna be extremely unhappy, as they are in Europe. The public will not be very happy in highly urbanized societies unless we find a way to get cleaner energy in to replace coal and get ways to reduce all of the difficult emissions that would be there if we didn't regulate them.

Amy Jaffe (27:33):

So, I'll tell you, you know, Ed, you raised a really important point, and I think that the public and even commodity traders have not really understood this. So, we're having a once in a lifetime disruption in natural gas markets, and that is because it's not just that we have this cutoff of gas supply by pipeline to Europe, but that gas cannot be rerouted anywhere else. There isn't liquefied natural gas capacity in Russia to shift it onto boats. And so there really isn't pipeline capacity to shift it to Asia. People don't really understand that.

So, before COVID, Europe was taking about 200 BCM of natural gas from Russia and now they're taking, I don't know, maybe 20 or 30 BCP from Russia, if that. And all that's going to China from those same Siberian resources is 15 BCM. We're talking about a giant loss of natural gas to the market, and then you have to add into it the fact that when everybody was planning what LNG projects were needed and who was going to have the most economic LNG projects, the Russians had three projects that were supposed to come online in the next five years or so, or maybe 10 years, that were another 40 million tons per gas per year. So, we have this massive loss of gas, both by what's staying in the ground in Russia and not moving to Europe, and for the effective cancellation of three major expansions in LNG. And it's not clear how fast we're gonna make that up.

The new projects that have been green-lighted by the largest companies, the sort of Shell and ExxonMobils and BPs, those projects are only something like 30 million tons a year LNG. So, we're not close to closing the gap, and I do think that's a challenge. And when you look at a country like India, you know, India is responding to that challenge indeed by investing more in renewables and upping the investment for hydrogen.

India does not see how it could import enough natural gas at affordable prices to meet that gap, and so you're seeing some governments revisit, you know, 'cause hydrogen is a seasonal storage option for renewables. You can take the hydrogen and you can put it in a tank and you can use later on in a fuel cell. You know, I think you're gonna have more interest in this thing we call virtual power plant, which they did in western Australia because it was not economical to bring the Australian gas to the western half of the country, and so they had continual brownouts. So, they did put in wind and some other resources, but one of the things they've done is they put a small battery in homes and businesses across

the region and then the utility taps the extra spare capacity in each of those small batteries to avoid brownouts.

We did see battery storage step up to the plate in California in this past September, because we had this heat wave that literally raised electricity demand and air conditioning demand by 60%. We had a 60% increase in the number of peak load electricity being demanded in California, and that was met without a blackout, somewhat by asking people, you know, turn down your thermostat, right? But partly, simply by the use of batteries. And so, I mean, it's not ideal to have to send a text message to every member of the state of California telling you not to charge your car at this particular moment in time, or turn off your lights where you can, don't do your laundry. But in the end, the lesson of California is that we have a lot of work still to do, but also that these new technologies did work, and we didn't have rolling blackouts in California.

Jorian Murray (32:06):

This sequence of conversation I think perfectly dramatizes that it's not gonna be a straight line and there's gonna be lots of things that people will not agree on. The one thing that we do rely on is global collaboration and people working together. That said, the world seems to me that it's less stable now than I can ever recall. Nationalism is on the rise. You talked about the war in Europe. Do you think these crises are gonna set back our progress or are there some maybe very thin silver linings to these crises? Ed?

Ed Morse (32:43):

No, I think it's both things happen. It's not an either or. It's an and when it comes to these questions. As I said at the beginning, there have been two steps backward and two steps forward and the backward part of it that we've seen in China and in Europe in particular for similar but very different reasons, they have to rely on coal and in the case of China, while they're going full steam ahead on cleaning up the new use of power generation, they still needed the redundancy. What have they done?

They are increasing their coal mining at home by a number that's equal to half of the coal production in the United States today. It's not a small number. So, there is a step backward and what is Europe doing? They're reopening coal fire thermal electricity production because they have no alternative but to do that in the current environment. So, you can accept the reality that you gotta do something other than you'd otherwise want, but you've gotta make the commitment to do something in addition to that which we've had in the U.S. and the European Union doing with these steps backward.

The problem of the transition is that it is as we said at the very beginning, revolutionary. It is disruptive. It is a system that gives, or a situation that gives rise to winners and losers at home and internationally and winners and losers at home and internationally have to be dealt with by some process that smoothes over those differences and makes people amenable to the investments that have to be made on the sustainable energy side.

Jorian Murray (34:25):

Amy, I'd like to talk about the role of global banks, and I'm asking you as someone who's objective and an academic 'cause some people might think, you know, "This is podcast is being supported by a global bank, why are they talking about energy transition?" Well, what is the influence of banks? How can banks help?

Amy Jaffe (34:44):

Well, you know, of course banks play an extremely important role and thinking creatively how to marry together private banking with sort of government development banks, is something that we've studied here at the Climate Policy Lab at the Fletcher School, and there's a huge potential here. Using the paradigm of Germany, which had a very strong development bank that worked with local banks to finance rooftop solar and other prerogatives put in place to decarbonize in Germany.

The National Development Bank played a very key role in the lending for local banks and also because you're having a development bank and you have experts in that bank, they were able to help local banks and local investors understand how to de-bottleneck some of the risk that comes, whether that's risk to permitting or other kinds of policies that need to be put in place to sort of fast track some of this investment.

We've seen that same thing happen with big Chinese development banks that have participated in China, not only domestically, but in their belt and road infrastructure investment activities abroad and the lessons are that these national banks have played a big role, not only in making sure that there's enough capital that's de-risked to give private banking the comfort to come in, but also lending the expertise for how to get projects going on the ground. But one of the things that comes out when you research some of these successes is that there's still other barriers that need to be addressed, whether that's land use allocations by local government or federal governments, whether we're looking at the need for pricing reform in the electricity sector in particular markets.

We have a lot of bankrupt state enterprise electricity entities around the world, so we need to think about how are we gonna revitalize those institutions or get banking and lending for interaction between new kinds of developers and integrating those traditional state entities into the process and this relationship between the national development banks and the private sector banks is a pivotal aspect to how we're gonna be successful in transitioning global infrastructure. I mean, it's just the most critical component.

Jorian Murray (37:32):

Ed, from a voice from within a bank, does it feel like it's a place where you can actually do good and help the world solve these problems that we've been talking about?

Ed Morse (37:43):

Yes, the banks have in fact always been community minded. By definition, they have to be community minded because they wouldn't be in business if they did not have a community that wanted to put their money there and borrow money from them.

But banks have been serving in several positive ways. They have come together to define principles of lending. They have gone to third parties to ask for a guidance on developing criteria for lending to energy-intensive industries such as steel. And they've looked within and said, "What are we doing in terms of the real estate that we occupy and how can we make that a significantly more energy efficient model?"

So, yes, I think banks because of the position, the business that they're in, which is in part providing capital to the world, have to be cognizant of both what is needed to create a more sustainable environment, um, and how they can selfishly get themselves involved in that.

There's one additional thing I would like to say about banks and that has to do with what an ideal world would be like in fostering the transition and what the world is that we live in. Fortunately, everybody who looks at the subject believes that carbon should be priced and that the best way to accelerate the transition is by having a price in the marketplace that increases over time so that the market can discourage people from doing things that are carbon-intensive and I could add methane-intensive to that as well.

And banks are serving a very important inter-mediating role in a world that, because of its fragmentation, does not allow for the development of a carbon price in the United States, let alone in the world as a whole. Europe has the only large economy that's succeeded in having a realistic and meaningful carbon price. China is trying, but it's at a level that is not meaningful. Uh, the U.S. has a fragmented system.

Meanwhile, we can trade carbon, we can trade carbon offsets, particularly carbon offsets that are dealing with direct carbon capture through reforestation and banks play a very important role in inter-

mediating that carbon pricing environment without which we wouldn't be able to accelerate with new instruments, the capital available for the transition.

Jorian Murray (40:01):

I fear that we've run out of time. I hope that is not symbolic of the subject that we've been talking about. You've certainly shone light on this such an important and complicated subject.

So, thank you so much for joining us today Amy and Ed.