

BIG DATA CHINA

CSIS Trustee Chair in Chinese Business and Economics and
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TRANSCRIPT

Big Data China Microfeature

Why Decarbonization Requires Globalization: An Interview with Michael Davidson

FEATURING

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Ilaria Mazzocco

Welcome everyone. I'm Ilaria Mazzocco, Senior Fellow at the Trustee Chair in Chinese Business and Economics and I'm one of the people behind the Big Data China Project, which is a collaboration between CSIS and Stanford Center on China's Economy and Institutions, which aims to bridge the gap between quantitative research on China and policymaking in Washington. And today I have the honor of introducing Michael Davidson, who is assistant professor at the School of Global Policy and Strategy and the Mechanical and Aerospace Engineering Department at the Jacobs School of Engineering at UCSD.

Which means that you're an engineer, Michael, but you also spend a lot of time thinking about some of the same issues that I think about. So, you know, the political economy of China, its implications for climate policy, clean tech supply chains, you know, de-risking and clean tech supply chains, what this all means and like the impact of decoupling and de-risking on climate policy in the US. Why don't you tell me a little bit about the work that you do and why you see it's important?

Michael Davidson

Thank you, Ilaria. It's great to be with you. And, you know, indeed, we do work on some similar topics, even though I have an engineer in my title. So I direct the [Power Transformation Lab](#) here at UC San Diego. And fundamentally, we believe the low-carbon transitions are about infrastructure and institutions and how they interact with each other. So we focus on a couple of key areas.

One is on renewable energy planning. So thinking about high dimensional analyses of where we build, considering power grids, but also land use and other socio-political factors. We're also concerned with power markets and how to make them more accommodating to low carbon energy, particularly in the context where you don't have fully developed markets and institutions, hence China. And we're also thinking about the political economy of industrial policy for low carbon technologies, both domestic priorities as well as the geopolitical contexts on clean energy innovation and deployment. And we spend about, over half of our work is focused on China, and we have also some other projects on India, Southeast Asia, and the United States.

Ilaria Mazzocco

That's great. That's really exciting. I think some of these topics are really sort of cutting edge and understanding some of the challenges for climate change and making progress there. But before we get into that, I was wondering if you can tell me a little bit more about what it means to do quantitative research and the challenges maybe that you face in doing the kind of research you do.

This is a project, the Big Data China, that's focused on quantitative research and explaining that to a public that maybe doesn't deal with that every day. So if you can just give us a sense of what that means for you and how you're approaching that.

Michael Davidson

Yeah, so we do both quantitative and qualitative work in the lab, but on the quantitative research side, I mean, both face challenges. But on the quantitative side, certainly many people have been thinking about this problem in China, particularly in the context of new data security laws. Historically, and that's even more true today, data is considered a resource within China. It is not traded freely, even between governments and state-owned enterprises. So that's always been a challenge for conducting quantitative research.

But on the other hand, other forms of data collection are expanding and opening up some opportunities. And so, I'm looking particularly at energy, power, and markets. We have one initiative called the [Electricity Market Tracker](#), where we are developing open models and data to assess the emerging power market designs in China. And we've had some success in getting enough data to actually say something meaningful about the impacts of these market designs on energy security, as well as emissions and some other outcomes that people care about. Now the sources are highly varied. So that includes official government sources, statistical databases that collect these official sources and are subscription-based. Also an increasing amount of open source databases that are collect for very specific bespoke topics, satellite data, as well as just good old fashioned scraping websites, getting into the JSON, looking at WeChat. Historically, we've also worked with getting physical copies of books and scanning them, though less so now. So there's a lot of tools at our disposal, but broadly speaking, what

we're trying to do with this and other initiatives is to open up the models and the data on these particular issues related to power and low carbon.

And here the idea is to, of course, to facilitate replicability and transparency, which is really important for academic goals. But it's also helping to take some of the scenario creation out of the hands of the incumbents and allowing some of these new actors to come in within the Chinese ecosystem and elsewhere to come up with their own scenarios and then run them in these models and through these and with these data sources to come up with alternative futures of how China can achieve low carbon goals. And then encouraging more creative uses of modeling tools that consider political economy factors. So the non-technical elements of system transitions, which is, I think, probably the most interesting topic facing China right now.

Ilaria Mazzocco

That's really interesting. Can I ask you a follow-up question on that actually? I'm wondering if you can talk a little more about what the political economy of the incumbents and other actors in China, you know, what it looks like when we're talking about the power sector and the energy transition and some of these dynamics that you're looking at.

Michael Davidson

Historically, in most country contexts, the grid companies play a really central role in deciding energy planning decisions and also influencing energy policy. So that's true in China and it's perhaps truer in China than in other places just because of the size and the scope of these grid companies. So following the 2002 reform, which broke up the original ministry that was then a state power corporation into different grids and generation companies, generation companies became a little bit more diversified, but grid companies remained really centralized. There are just two giant grid companies in China for the most part. There's a couple of small ones that we could get into if you're interested, but two major grid companies.

And they really have a huge impact on what the energy policy discussion landscape is, both through their access to data and models internally and knowledge of how the power grid operates and just the historical impact that they've had on shaping energy policy.

So what does that mean? Well, that means if you want to address energy security challenges in China and you need to address low carbon transition, then you did have a certain amount of data and models to do so. So you're probably going to work with the grid company to do that, whether you're a researcher or government institution, research organization, et cetera. Now, the implications of that are that you want to find areas of interest with a grid company where your particular interests align. Now, they may not always align. And that's a really important space that we should be looking at.

If we think about where we could go, if we had more expanded access to data and models of China's power system, we could start making some more interesting analyses on what are the trade-offs between distributed energy and large grids. Where grid companies like to have large grids, and maybe they're not super excited about having a lot of small solar rooftops. We can also get into thinking about what are different ways of structuring the markets? Currently, China is in a really vast reform of markets where over 50-60% of electricity sold in the country now is through markets, not through plans. But the grid companies and the grid affiliated groups all essentially control that process, the design of that, and the exchanges, and the clearing, all of that.

What are other ways that we can think about it? What are improved regulatory frameworks for those markets? As well as thinking about how do we improve the regulation of the transmission and distribution grid itself to make it more accommodating and incentivize a higher use of low carbon energies? These are all really important questions that with more open sources of models of data, we can really start to grapple with.

Ilaria Mazzocco

That's really interesting. And I know that you've done a lot of work on this. And you've also written recently about coal and China's dependency on coal. And I think that's one of the key issues here that we're trying to get at. How can this part of the power sector reform and how can these dynamics be shifted in a way that facilitates the shift away from coal?

Can you talk a little bit about what those issues are? You wrote a really interesting article in [Foreign Affairs](#) recently about this.

Michael Davidson

The sector is really undergoing just dramatic upheavals left and right. And so just two years ago in [a separate article](#), I wrote about the power crisis and what was going on in China in fall 2021 that led to over 20 provinces losing power, getting residential consumers, factories getting shut down because of lack of capacity. And at that point, there was some weather problems, but it was really institutional problems, institutionally exacerbated problems from coal supply tightening, driving up prices, incomplete electricity markets that weren't passing through prices, and then unwilling coal generators that would rather shut down or fake outages or do this or that in order to avoid generating at a loss.

Now that prompted some responses on the coal market side to make the markets more flexible and it prompted some additional policies to expand coal supply. And so we've seen some sort problematic language around coal as the kind of center of China's energy system, but it also prompted a lot of new coal capacity being permitted and built on the system and allowed, even though according to most interpretations of the regulations, you really shouldn't be allowed to build any new coal plants unless they're very large and or for particular combined heat and power purposes and serve a particular niche. In this case, in the last few years, we started to see over 100 gigawatts of new coal permitting and or construction taking place with a nominal goal of meeting energy reliability. In order to avoid blackouts.

The challenge with that is that most of these coal plants just don't make a lot of financial sense, and they're probably not needed even from a reliability perspective. But again, because we don't have all

of the information related to the grid, we can't say with really high confidence exactly how much of that coal capacity is needed and where. That requires a highly sophisticated form of modeling with lots of additional data, and that's something that we're working towards now.

But I think at a high level, we're quite confident that China has a high degree of overcapacity in the coal sector. Building more coal plants wouldn't have solved the 2021 crisis because that was about a coal supply and a market problem, not an insufficient coal capacity problem. And you also have some sort of structural problems with targets and incentives around coal plants that are driving this new coal boom.

And so in particular, China has two key peaking targets. One is to peak coal use by 2025 and peak carbon emissions by 2030, but neither of those specify a level. So if you know that you have to peak and slow down at a certain year, well, but not at a specific level, then you may be incentivized to really rush to build a bunch of things and then lock in that high level because you know you're not going to be getting any chances later. And so we see a little bit of that kind of gaming in the system.

Also, of course, China is under a huge economic pressure and local governments are looking for ways to stimulate investment left and right. This is another one of those examples. And then because of the power reliability crises in 2021, and then again in 2022, reliability in any kind of power reliability issues is really salient for local government officials right now. So they're very risk averse when it comes to this relative to some of the other issues.

Now, having said that, coal plants are showing the overcapacity, so coal plants are being utilized less and less. Using coal plants as a backup could make sense, but you need the markets and the right incentives to do so. And so China, late last year, put in place a capacity payment mechanism targeted at coal plants that kind of pay them to be there. In principle, this could be a workable solution, but the couple problematic aspects are that it's a fixed payment, there's no market. And second, it's just paying coal. It's not paying for any other resources that can also provide that capacity. So what we're seeing is that the incentives kind of across

the board are kind of pushing for more coal plants, even when they're not needed by the system. And then frankly, the state-owned Gencos (generation companies) don't necessarily want it either, right? So we're seeing some very unusual activity with this explosion in new coal permitting.

And it's probably likely that not all of these coal plants will eventually get built because of all of these headwinds, but it is very problematic for near and medium term carbon emissions in China.

Ilaria Mazzocco

That's really interesting. And I think it's particularly interesting because over the past four years, there's been this sort of tension between all these new targets and the decarbonization goals. And at the same time, the reliability of the system and now this coal spree, if we can call it that. And, but at the same time, when you look at China's performance of renewables, it keeps outpacing expectations and China is in many ways leading by leaps and bounds at the rest of the world when it comes to renewables.

I know you've written a lot about China's role in the sort of supply chains for a lot of these technologies ranging from EVs to solar panels and how this is playing into dynamics here in the United States and concerns over reliance on China. Can you speak a bit about that and some of the work that you've done? You did a fantastic paper that you published, was it last year? Two years ago, I guess now.

Michael Davidson

Yeah, we had two papers ([Nature](#), [Science](#)) in fall 2022 on this topic. One of them was on decoupling or derisking, right? Similar ideas there. We're motivated by the policy debates around decoupling, but that lack real specificity around what are the objective assessments of the risks and benefits of integrating with China on low carbon technologies. So what we did was identify five categories of risks from economic and national security dimensions. And then we also looked at five different technologies. And we basically assessed each of those through case studies. Okay, what is the risk of integrating with China with

respect to critical infrastructure control and the green steel? And then we, you know, we did this kind of analysis to identify what are the sort of objective risks here? And then what are some mitigation measures?

The broad takeaway is that diversification creates some generic benefits, but there can be specific costs of decoupling or de-risking, and it depends on the technology and the timeframe. Economic risks are much more heterogeneous, while national security risks are more muted across the technologies and the risks that we studied. We do identify in this that there are some potential needs for government facilitation, for some joint demonstrations. Which actually showed up in the Sunnylands statement that was on climate change that was signed between the two climate envoys late last year before APEC. And then finally, we're looking at what are the importance of maintaining key flows in the system related to capital, talent, technology innovations, and products.

And so the second paper really dives in more quantitative detail at the solar sector. And this we're looking particularly at what are the globalized benefits of solar to learning curves and the reduction in solar costs over the last 15 years or so. What we know is that the world is, of course, heavily reliant on China for all steps in the solar supply chain from the wafers all the way to the modules. And the costs have fallen really dramatically since 2010, 80-90% in the decade following 2010. And this is large part due to China and China's position in the global supply chain.

What our study did was we looked at what would happen if learning, which we broadly assume was sort of globally shared during that period, were instead constrained to only occur within China, the U.S. and Germany because of nationalistic policies that prevent the flows of capital and technology and talent. If you're only learning from your own deployment and not from the global deployment, then your costs fall at a slower rate. Through this model, we're able to calculate, okay, over that decade, in the span of that 10 years, the U.S., China, and Germany all tried to completely nationalize or move domestic the entire supply chain of solar, what would be the hit in terms of learning and increased costs? From this, we determined the global supply chains saved U.S. consumers about \$20 to \$30 billion over that decade. German

consumers, less than that, less than 10. And China, of course, had higher benefit because they were also benefiting from exporting these solar panels and the learning that they get from the global. On the order of 30 to 40 billion. There's significant amount of savings from maintaining these global supply chains.

The key questions for me going forward are, what are the relevant aspects of this globalized supply chain and global learning that we need to maintain to continue to reduce costs going forward? Because sure, solar is cheap now, but it needs to be dirt cheap in order to really push our energy system to accommodate high levels of renewable energy because when you start pumping in so much solar, you start also wasting more of it because you can't accommodate all of it when it comes. That requires solar to get really cheap. And separately, there's a sort of secondary impact on other countries, right? So U.S. consumers are happy to pay a premium for solar panels. Well, we may not know it, but we are paying a huge premium for solar panels compared to the rest of the world. But third countries, like if you look at developing Asia, the price point between solar and coal is really important for their energy transitions. We need to make sure that solar and other renewable technologies and EVs continue to fall in cost dramatically so that they can adopt them and avoid these very high fossil-intensive development pathways.

Ilaria Mazzocco

And implicitly, I think what you're saying is a lot to achieve that a lot of those supply chains are going to continue to have to go through China essentially, or Chinese companies.

Michael Davidson

Well, I'm not implicitly saying that needs to happen.

What we do think is that the supply chains need to maintain a certain degree of openness to globalization. First off, we should just recognize that China actually is not a major exporter of solar panels to the United States and has not been for many, many years. Chinese firms, yes, export, but through supply chains in Southeast Asia and elsewhere.

If we want diversification, say geographic diversification, then moving to multiple countries while still maintaining our technological learning seems to me a very advantageous solution. Now, if we want diversification and technology pathways, right, we don't want to rely upon the crystal and silicon that China is really dominating, instead, we want to have thin film solar, which is, leading by a U.S. firm, then we might want to have some other technological diversification strategies there.

But for me, I think the sort of fundamental premise is we need to maintain free globalized flows of capital, talent and technology in order to continue to have these increased learning benefits. So if for example, a Chinese firm comes to the U.S. and wants to set up a solar factory and bring all that knowledge that they had, that they developed, and build it here with American workers and satisfy all our other constraints, that should be something that we should welcome. In the end, I don't think it's going to be just Chinese firms in this space. I think there's a lot of opportunity for innovation, and I think there's a lot of opportunity also to look at different types of technological niches.

The flip side of that, of saying we're going to completely try to cut off the global leader in supply chains in this technology and who was the majority responsible for bringing down costs over the over the last 15 years in the sector. That seems foolish if our goal is to also try to achieve very low cost renewable energy, not just for us but for other countries.

Ilaria Mazzocco

I think that makes a lot of sense to me and it's consistent with some of the issues that I've been looking at. And actually this touches on the next thing I wanted to talk about a little bit which is our green industrial policy. China has obviously done this pretty well. And there's obviously continuously accusations that solar panels in China are cheap because they're highly subsidized, right? We can talk about some of the other advantages that China has when it comes to manufacturing and scaling these technologies. But when it comes to what the U.S. should be doing, we obviously have the Inflation Reduction Act now. There are a lot of incentives to develop these supply chains here. Also some incentives for

diversification globally. But I certainly am concerned that sometimes when it comes to the trade side of things, maybe we're not spending enough time thinking about the implications on global trade of these sort of industrial policies that we're introducing at home.

So how do you think of all these issues? The interconnectedness, the trade issue, the industrial policy issue, the Chinese industrial policy, and what the U.S. should be doing and thinking about right now?

Michael Davidson

I think that's a great set of questions. We did have a report from a couple of colleagues in the UC system on climate and trade. And we had a climate and trade task force report, which covered a number of different sectors, but including clean tech. And in that, we reflect upon what is the impact of various U.S. trade related barriers in clean tech and achieving their policy goals? And then what are some other ways that we can achieve some policy objectives while also maintaining some basic levels of trade that would be necessary to keep the technology, keep technology flows, and improve learning? But we'll take a step back here and say, okay, what was China's role? How was China able to successfully move into the sector?

It's a combination of a lot of different policies. You certainly had central level support for some of these early technologies, identifying them as strategic. There were, in some cases, also domestic content requirements, which helped to advantage local producers that were coming into this space, kind of infant industry support. But then there was also a lot of bottom-up local government support to generate ecosystems that worked for these particular firms. So if you think about, you don't want to just go to a random city and build a solar module factory. No, you want to think about, okay, I'm going to need access to high quality equipment. I'm going to need access to these wafer. I'm also going to need highly skilled work. I have to think about where the silicon is coming from. There's all sorts of different aspects that you would have to think about. And local governments that thought strategically about how to develop those ecosystems tend to be

more successful in developing those really efficient enterprises and attracting the right talent. And we're not talking just about formal inventions that show up on a patent. There's also a lot of tacit knowledge that is developed as you scale up these technologies. The challenge with that is, of course, it's a lot more difficult to quantify and pin down. But the impacts of it are very real, right? We know that China is able, these Chinese firms have been able to take a technology which was pioneered elsewhere and was being built at scale and manufactured at scale in Japan and Germany and other places. And they were able to dramatically reduce the cost of them such that they could become really competitive globally.

Now, subsidies of course helped, but you can't subsidize your way to the where entirely to where it costs of solar panels are today. And the fact that now these solar firms are competing overseas in Southeast Asia and even opening up plants and making projects here in North America really shows that they have some very key technological and tacit knowledge advantages that really are crucial for these technologies going forward. If you kind of think about kind of where China came from and how it was able, how these firms were able to really dominate in this space, there are some lessons for the U.S., which I think is what you're getting at. But we're also at a different stage in this technology development, right? We are not in a stage where there is no kind of viable, very cheap solar wind and battery ecosystem. No, we have all of those now, and now we're trying to expand production and make them even cheaper.

The first element of this is separating industrial policy from protectionism and trade related barriers. Because you can have industrial policy that does not create these insurmountable trade barriers and deflect or harm global flows and learning. For example, you could have a policy that would support manufacturing in this country, but allowing foreign firms to come in and take advantage of that. You could have policies that would say, okay, we want to support a particular technology pathway, but we're not going to put high tariffs on alternative technology pathways if they turn out to be better and cheaper options for what we're going for now. And you go down the list, there's a lot of examples where you could think about developing ecosystems, but allowing those firms the flexibility of working with whatever

global suppliers makes the most sense for their technology and to advance in their niche, rather than pre-specifying or putting up too high of barriers to constrain them, which in the end will just hurt their competitiveness because then they're not going to have the best access to the technology and the types of contractual arrangements and supply chains that other international firms will have access to.

So I think there are some lessons from the Chinese side. But there's also some lessons based on where the history of U.S. trade policy in the clean energy sector that we should be learning from.

Ilaria Mazzocco

Thinking about trade with China, a while back, we did a review of what economies think about the impact of the “[China Shock](#).” So China's entry into WTO in early 2000, its impact on manufacturing jobs in the U.S. We found that there's a diversity of views on exactly how that played out and the impact on certainly declining jobs in certain locations and among certain communities, but actually potentially some increase in jobs elsewhere in the United States. But generally speaking, do you think we are at risk of a different kind of “China Shock” when it comes to sort of green tech or these new technologies that are central to decarbonization?

Michael Davidson

I think the short answer is no, because there is quite a different type of structure. Let me get into that, because I do think this is a really important aspect of maintaining a robust climate policy in the United States. The basics of it are quite different, right? The “China Shock” was, in common speak, referring to U.S. manufacturing jobs which are being lost because now low cost Chinese suppliers are able to get into this market and sell into the U.S. because of these reduced trade barriers and all of the benefits from WTO accession. We're not in a situation where we have millions of U.S. workers manufacturing clean tech that it's risk of being sent over to China. In fact, it's almost the reverse, right? We have massive Chinese manufacturing and we're trying to rest control of it and move those manufacturing jobs here.

The challenge is harder, right? And the shock is somewhat different in the sense that now the established manufacturing firms and supply chains are emanating from China. As I said, there are ways to think about how to address that kind of challenge and build up more manufacturing bases here. And the experience that we've seen from the Inflation Reduction Act is, when you throw a lot of incentives and money at the manufacturing side, foreign firms want to come in. Now it's a question, do we open the doors to them, or do we just say, no, only U.S. firms or only certain subset of firms can come in and build manufacturing facilities here and take advantage of those credits. And I think that's a really important debate that we need to have and interrogate. But it's clear that if you set the right incentives that manufacturing will be shifting, right? It can be shifted, right? That's a no-brainer.

But to say, to completely shift it, the decoupling, or to specifically target which countries you want the manufacturing to go to is a bit more challenging. Because you need to allow firms some flexibility to choose the right suppliers for what kind of technology they're trying to innovate and what the consumers want, et cetera.

The other part of this, which I think is oftentimes lost, is just the fact that manufacturing is a reasonable but still a non-majority percentage of green jobs in the United States. When we deploy a solar panel, maybe 10-20 times more jobs are associated with the project development, the project construction, maintenance, all the other soft costs and labor that go into deploying that, not the actual building of the panel that's installed.

If we're worried about jobs in aggregate, we should be thinking about that full supply chain of the full value chain of where all these jobs are going, coming from in order to deploy green energy and meet our targets. Now, it's great if we can also get manufacturing jobs, but we don't want to sacrifice the overall level of ambition and development and jobs that come from the total expansion of the sector in order to save that, in order to expand just marginally some manufacturing jobs.

I think we can do both and on aggregate, the green jobs in this country are going to explode. They're already exploding and they're going to explode even more. We know that. And the only

thing we could do at this point would be to shoot ourselves in the foot by making that transition more costly and more difficult to do. On the other hand, we also need to maintain the right political coalitions to keep kind of policy where it is and then to pass the next inflation reduction act. Because obviously one IRA isn't going to get us there.

That requires us to think really carefully about, okay, we want to have manufacturing in this country. Yes, that's great. Does it really matter what firm is participating in that manufacturing plant? Maybe it does depending on the technology and maybe there are some technologies where we're okay having some Chinese participation in the plant or at least in upstream suppliers in order to get those manufacturing jobs here in the United States. We spent a lot of time thinking about solar. I think the electric vehicle sector is going to be a lot more central to this. And you know a bunch more about the sector than I do, right? Because this is an area where I wouldn't call it quite a China Shock. But we, of course, have a huge auto industry that's getting upturned because of the electric vehicle transition. Now, that's not caused by China. But now we have this interesting juxtaposition where China is also a world leader in EVs and batteries. It may actually make a lot of sense for some of these U.S. automakers like Ford, to take advantage of these great battery technology. The Chinese firms have been developing for many years while, you know, while we've been basically, you know, slow walking this transition. That may be really advantageous for the transition with respect to the U.S. auto industry and labor in that sector, but only if we can think carefully about what are our priorities in pushing for these domestic manufacturing, domestic jobs in the auto sector kind of more writ large. And do we have some ground rules on what we think is acceptable or not acceptable participation of these Chinese and other foreign firms.

Ilaria Mazzocco

Thank you. Obviously, this is a topic that is close to my heart. And I think something I'd say is that we've learned the lesson from China that you need to support these industries, but it's almost like we're selective in what we're looking at, right? So we looked at all the subsidies and the tax credits, but we're forgetting how

important FDI was to getting a lot of these industries off the ground in China.

We need to think a lot more creatively about how FDI can be really central to the United States. And we're seeing a lot of the FDI in the battery sector, for example, here in the United States right now. And it's great, right? It's actually helped really push the industry forward. And it could be transformative. So that's definitely an area to keep an eye on and see how Chinese firms do, especially now as they could continue to internationalize. Certainly a company like BYD is sort of incredible in the number of factories that it has announced recently. So we'll have to see how that affects the supply chains.

Thank you so much Michael, this was a really interesting conversation. I think I could keep talking forever but there's only so much time. We'll have to have you again and perhaps feature some of your work at some point. Thank you so much.

Michael Davidson

Thank you, Ilaria.