

Building to Zero: Inflation Reduction Act, a platform for growth

MY: [00:00:00] Welcome to the podcast that explores the world of private markets. I'm your host, Maribel Yoo. On this episode, we'll be discussing the Inflation Reduction Act of 2022, which the Federal Government signed into law on August 16th, 2022. This legislation directs new federal spending toward reducing carbon emissions and lowering health care costs. Joining me to guide today's discussion is Bhavika Vyas, managing director and member of the Responsible Investing Team at Stepstone. It's also an honor to have special guest Julio Friedmann, chief scientist at Carbon Direct, join this episode. Bhavika, please take it away.

BV: [00:00:32] Thank you, Maribel. To get the conversation started, I'll give a short overview of the Inflation Reduction Act so that our listeners are aware of the intent and some of the details. The IRA scale dwarfs anything we've seen before. In 2009, the American Recovery and Reinvestment Act included 90 billion in funding for clean technology. The IRA directs \$369 billion in federal funding to clean technology, with the goal of substantially lowering the nation's carbon emissions by the end of this decade. Given the dramatic cost declines in wind, solar, and energy storage over the past decade, the IRAs purchasing power far exceeds that of earlier federal programs. The funds will be delivered through a mix of tax incentives, grants, and loan guarantees. Clean electricity and transmission command the biggest slice followed by clean transportation, including electronic vehicle incentives. Incentives will materially reduce renewable and other carbon free energy costs, with the potential to drive increases in carbon free energy deployment to 65 to 80% of electricity by 2030. The act aims to catalyze investments in domestic manufacturing capacity, encourage procurement of critical supplies domestically or from free trade partners, and jumpstart R&D and commercialization of leading-edge technologies such as carbon capture and storage and clean hydrogen legislation of this magnitude and duration lasting to the through the 2030s and beyond is likely to have meaningful and lasting impacts across the US and global climate and energy systems, supply chains and related industries. Now to get into some of the numbers, the majority of the energy and climate funding is in the form of tax credits.

BV: [00:02:15] Corporations are the biggest recipient with an estimated \$216 billion worth of tax credits. These are designed to catalyze private investment in clean energy, transport and manufacturing, and include many technologies and approaches from efficiency and EVs to nuclear and low carbon hydrogen. It could be that these tax credits are underestimated. Most of the credits are actually uncapped, so the total value of the credits could be even more material. We would categorize these credits into a few key areas: renewables, energy efficiency, and climate tech. The IRA supports solar and wind with familiar tax credits while extending the horizon significantly. Historically, they have been renewed at the last minute and for short periods of time. Importantly, it also extends similar incentives to nuclear power, both existing and new, as well as to manufacturing of climate related hardware. Some \$43 billion in IRA tax credits aimed to lower emissions by making EVs energy efficient appliances, rooftop solar panels and geothermal heating and home batteries more affordable. Qualifying EVs, for example, will be eligible for a tax credit of up to \$7,500 and \$4,000 for new and used vehicles, respectively. Another example of this is that there is a \$2,000 per year customer consumer tax credit for the purchase of heat pumps, heat pump water heaters and biomass stoves and boilers. Some of the tax credits are expansions or extensions of existing tax credit, including the wind production tax credit and the 45Q carbon capture tax credit, which is going from \$50/ton to \$85/ton, an increase that unlocks profitable carbon capture in several new applications and industries.

BV: [00:03:55] This tax credit increase is expected to reduce carbon capture by an additional 100 million tons by 2030. Other tax credits are brand new, such as the 4V hydrogen tax credit or blender's tax credit for sustainable

aviation fuel. Manufacturing facilities are also only eligible for full IRA tax credits if they meet prevailing wage and apprenticeship requirements. Many IRA tax credits also contain scaling domestic production or domestic procurement requirements. For example, the bill could remake the US auto manufacturing industry. Not only does it extend a great deal of support to domestic manufacturing, it also sets standards for domestic materials production and recycling. These sustainability standards will favor low carbon supply chains and materials production. The US Department of Energy's loan program office will also receive roughly \$12 billion in loan guarantees to expand their existing loan authority by ten fold and create a new loan program capped at \$250 billion to upgrade or replace energy infrastructure. This funding accelerates early-stage decarbonization technologies and projects. It also includes \$27 billion for a national climate or green bank, which could then leverage ten times that amount of private capital. This is the third piece of legislation passed since 2021 that seeks to improve US competitiveness, innovation, and industrial productivity. The Infrastructure Investment and Jobs Act and the CHIPS & Science Act and the IRA have partially overlapping priorities.

BV: [00:05:23] The IIJA includes \$110 billion of new energy and climate infrastructure funding in addition to the \$369 billion now included from the IRA. What does this mean for emissions? The Rhodium Group expects that GHG emission reductions of more than 30% below 2005 levels as a result of the legislation. Princeton University's Project Zero Lab estimates that 1 billion tons of GHG emissions will be reduced by 2030. So that hopefully gives you a sense of the scale and the scope of the IRA. With that, it is my great pleasure to now introduce our guest speaker, Julio Friedman. Dr. Friedman is one of the most widely known and authoritative experts in the US on carbon removal, CO₂ conversion and use, hydrogen industrial decarbonisation, and carbon capture and sequestration. Presently he works on the science and research team at Carbon Direct, working with clients to solve major technical challenges around carbon management and removal. Dr. Friedman recently served as Principal Deputy Assistant Secretary for the Office of Fossil Energy at the Department of Energy, where he was responsible for the DOE's R&D program in advanced fossil energy systems, carbon capture and storage, CO₂ utilization, and clean coal deployment. More recently, he was a senior research scholar at the Center on Global Energy Policy at Columbia. He has held positions at Lawrence Livermore National Laboratory, including chief Energy technologist. Julio, thank you for joining us today. We're happy to have you.

JF: [00:06:48] It is such a treat to be here. Thank you very much for having me.

BV: [00:06:51] Wonderful. Well, maybe I'll go ahead and kick it off with a few questions, and we'd love to hear your thoughts on the scope and impact of the IRA. I know there's been quite a bit of excitement around the IRA since it's been announced. I'm curious if you've seen any big differences between what was expected from the legislation and what's actually been passed.

JF: [00:07:11] Well, we have to remember that people didn't expect this legislation a month before it passed. Senator Manchin publicly announced that build back better was dead, dead, dead. So people had gone round and round on whether this would even happen. So it's noteworthy that it exists at all. Once it was revealed the content of the bill was shocking, both in terms of its size and scope. So you've talked broadly about the \$369 billion or more of authorities that are in there, but the fact that it covers everything from heat pumps to nuclear power plants creates new authorities like the low carbon hydrogen tax credits. All of that was quite astonishing. So it's noteworthy because that is in fact, the only way to get to zero. The only way to get to zero emissions is to do everything across the entire system. And so Congress really stepped up to the plate on this one.

BV: [00:08:07] Well, we're happy, certainly happy that they did. I know the IRA is designed to promote rapid demonstration and deployment of clean technologies, you know, helping catalyze decarbonization of some of the harder to abate sectors. How is this opportunity in climate today different than clean tech 1.0?

JF: [00:08:25] Clean tech 1.0 was premised on the idea of sort of an endlessly scalable, open white space like in the tech industry that was clearly wrong. And Clean tech 2.0 had a similar kind of basis. The idea was just if you labeled things and you had enough clarity that the market would auto correct towards this. In point of fact, what you need to enter the energy markets is a great deal. A lot of these are capital intensive projects in industries. A lot of them need a great deal of time to vet and prove in the field. In many cases, even with the clean tech, it's not market competitive. So you need some kind of market aligning policy to bring these things forward, either with a demand pull or with low cost supply. So the IRA really changes everything because it provides all those things. A lot of the tax provisions that are in there run for 12 years. So it is steady and secure enough that you literally can take it to the bank. Some of it is large enough that things that couldn't have been financed before now are financeable. Green hydrogen is a good example of that. Large carbon capture projects on cement plants is another one. Last but not least, it really does bring a lot of options into price parity with existing market conditions or options. That's very different. So we're seeing whole new business models jumping up, whole new companies jumping up, big infrastructure projects. All of these things. And, you know, I wake up every morning excited about what to do.

BV: [00:10:04] We certainly do, too. It's interesting that you say that the regulation was not expected, but it's also transforming several different business models. And I'm curious as you think about that and how investors have been investing prior to the regulation being passed. I know we talked a little bit about the different business models, you know, some of which were reaching cost parity without the regulations, some of which are now leapfrogging to that and some of which may have more scaling and more cost reduction to go. You've mentioned carbon capture, sustainable aviation fuel, clean hydrogen. I'm curious for your differentiating views on those. And also one of the things we've heard about from certain groups is the difference between things like point source capture versus direct air capture in their development.

JF: [00:10:51] Thank you, Bhavika. And it is true that the hard to abate sectors, which you mentioned earlier, got special attention in this bill and not just electricity. A lot of prior provisions were really focused on renewable power, wind, solar, et cetera. This is very much a broader cast, including things like efficiency, which you talked about before. Carbon capture is one where the business model has probably changed the most. For the prior legislations, the 2018 amendments to the tax code, you were looking at \$50/ton. At \$50/ton for solar information storage, that was enough to get some hydrogen facilities, most ethanol plants. But that was it. It was not enough to get steel or cement. A lot of the power sector was simply out of scope. At \$85/ton, that's all changed. So the net zero America report from Princeton you mentioned earlier sees that by 2030 you get an additional 100 million tons of capture. By 2035, you get 400 million tons of capture. That is radically different. That's a factor of 15 scale up. And we are seeing now many players coming onto the field going after that. Another way that that has changed is that in the 2018 drafts, it was the case that you would make more money doing carbon capture with enhanced oil recovery. The IRA has flipped that. So you now get more money for not producing oil and instead doing straight saline aquifer storage. That has changed the business models to open up the range front to a whole bunch of new players because you don't need to produce oil, you don't need to access an oil field, you don't need to be an oil company.

JF: [00:12:34] So we're seeing companies like Air Liquide, Air Products. Praxair, The LNG companies, chemical plants owned by Dow. You're seeing all of the ethanol plants getting into this in a very big way. Biorefineries, combined heat and power systems for towns. All of these things are suddenly now in play. One other example that I want to point out, you had mentioned a moment ago, which is around hydrogen. There was already a decent sized hydrogen industry in the US. We make about 10 million tons of hydrogen a year. Almost all of that was going into fertilizer and going into refining. With the 45V tax credits, which are brand new, you can receive up to \$3 a kilogram tax break or tax incentive. That is enormous. \$3 a kilogram means that in parts of the country, green hydrogen will be cheaper than any other form of hydrogen, including gray hydrogen, the traditional polluting process. And so having suddenly be able to bring these new kinds of hydrogen supplies, one, you're getting a whole bunch of projects announced. You're getting a whole bunch of new hydrogen companies announced. In addition to that, you're seeing new uses for hydrogen making ammonia for export to Japan or use as a maritime fuel, blending into the natural gas pipeline systems in the city of Los Angeles. You're getting a whole new set of applications which are possible because of low carbon, low cost supply.

BV: [00:14:05] Thank you, Julio. That's really interesting in terms of differentiating between the business models. Following up on that question, as you look at the flow of capital into climate today, are investors painting it with a broad brush, particularly with the exuberance around the IRA? Or are you seeing really differentiated approaches to valuation and accurate incorporation of the magnitude of the impact of the IRA on different business models?

JF: [00:14:32] A bit of both. You're certainly seeing enormous amounts of capital coming into the system, and that is true for small modular reactors and for sustainable aviation fuel and for heat pumps. Like you're seeing it across the board, a lot of money is coming in and the valuation of a lot of companies has jumped as a result of that, which is quite welcome. Even some ancillary companies like just carbon tracking software or battery manufacturers. Crews like these guys are also getting big bumps in the market, which is, again, not a surprise. That is not saying that it is accurately valued. There is a certain amount of irrational exuberance out there as well. One example of this that you mentioned just a moment ago was direct air capture and CO2 removal. That's a whole new enterprise. People are very excited about it, everything from biohydrogen with CCS to mineralization and of course, direct air capture, pulling CO2 out of the air and oceans with big machines. The valuations of some of those companies has been kind of crazy. And a lot of companies that might not normally have gotten investment are suddenly getting investment because people don't want to be left behind. But in point of fact, it's very hard to operate that business. This is one of the things Carbon Direct does. We try to understand where you should invest and what kinds of companies and projects will succeed. So even though I'm enthusiastic about the new field, even though I believe a lot of these companies will succeed, that doesn't mean their valuation is correct. That doesn't mean the amount of money flowing into the sector is correct. And you could say the same thing about any of these pathways.

BV: [00:16:11] Yeah, no, that's helpful. And it's certainly something we as investors need to be able to think about and really evaluate our investment partners on. Is their level of thoughtfulness, judgment and discipline around this.

JF: [00:16:22] One quick addition to that. One of the things that people are realizing is all the cheap supply in the world doesn't necessarily guarantee demand. You can make low carbon steel. That doesn't mean a car manufacturer will buy it. You can make large, low carbon hydrogen. That doesn't mean a fertilizer plant will buy it. So part of the reason why is because if you're an automobile manufacturer or a fertilizer, you need

guaranteed supply. You better have that low carbon supply when you need it, at a fixed date, for a fixed price. That level of uncertainty for, say, a cement manufacturer or a steel manufacturer is something that's very hard to manage without sort of strong market pull. So we're starting to see in some sectors outside the power sector, for example, you're starting to see requests to firm up demand from various parties. And again, we're innovating in the business models and there's policy innovations that people are considering to try to get that job done.

BV: [00:17:18] That makes sense as something that needs to be considered thoughtfully in investment decisions. We spoke about how transformative this bill is, you know, in combination with the bipartisan infrastructure bill. What should investors and management teams be considering, perhaps in terms of how to access this funding or, you know, things they should really think about in their planning when they include this type of funding?

JF: [00:17:43] Sure. One of the most important things is because these are tax code provisions, they go through the IRS. The IRS has not issued guidance for all of these new provisions or amended provisions. And as that comes forward, you'll gain clarity on what is in bounds and what is out of bounds, for example, around safe harbor provisions. That kind of guidance will make or break a bunch of projects. So even though I think the legislative language is clear, getting guidance from the IRS is important. Let me give you just one example of that. In the new 45V tax provisions, this is again, the clean hydrogen provision. It requires a life cycle analysis of the footprint of the hydrogen production done with a particular model, the great model out of Argonne National Lab. You better understand that model really well, even if you do. Even if you do your make your estimate, you're pretty confident that you're going to make a certain threshold for tax payment. But you really need to understand the IRS guidance because if you get the best credit, it's \$3 a kilogram. If you get the next best credit, it's \$1 a kilogram. That's a big difference. And so you really got to understand those kinds of provisions and IRS guidance to make the money.

JF: [00:19:00] Another thing to understand is many of the provisions in the IIJA, the Infrastructure Investment and Jobs Act, sometimes called the bipartisan infrastructure law, a lot of those provisions go straight through agencies. So you need to apply for grants. It is a lot of non-dilutive capital out there and I do mean a lot of non-dilutive capital. \$8 billion for hydrogen hubs. \$3.5 billion for direct air capture hubs. A lot of money for fueling infrastructure – both electric vehicle charging, hydrogen fueling stations. Money for ports. \$17 billion for sea ports. \$25 billion for airports. It's great, but you have to go through the government to get that money. A lot of companies have not had to do that before. You have to read the FOA, the freedom of access solicitation and follow all the provisions. You have to have a government DUNS number to apply. You have to follow the logic of these things. In many cases, a solicitation comes out and you have six weeks to respond. Like many companies are not prepared for this. They need to start getting into the rhythm of what it's like to work with the Department of Transportation or the Department of Energy in order to receive this non-dilutive capital.

BV: [00:20:15] As we think about other bottlenecks, such as, you know, bottlenecks and storage, charging infrastructure or supply chain or anything else, as you sit back and look at the business models where we're considering and excited about, [00:20:30] but also some of what you described around, you know, other expertise that's needed to really access this. What else outside of the funding does the space really need to grow and scale?

JF: [00:20:41] There's three things that keep me up at night where I really believe there is a risk if you don't do this correctly or we're going to hit choke points. We have a lot of tailwinds. Tailwinds do not remove choke points. They still exist. And if you don't get rid of the choke points, you have pile ups. First of these, top of my list is human capital. We do not have at any scale in any sector, at any level. We do not have the human capital we

need. We don't have specialty welders, whether that is pressure vessels for nuclear power plants or people who work below waterline. We don't have enough of those. We don't have enough high power electricians. We also, though, don't have people who are doing the permitting and regulation. Most tax equity lawyers are not familiar with this stuff. They're in completely new industries which they don't understand. There's some idea that you can take somebody who's a solar power project, tax equity lawyer and just move them into these other sectors. Like that's not exactly true. And we don't have the scarcest resource. We don't have people who have built billion dollar projects. We don't have really good project managers to bring these things online. So the human capital is a huge concern.

JF: [00:21:48] Second choke point infrastructure on any level for anything. We don't have the comprehensive infrastructure we need. I'd mention that Princeton report, Net zero America earlier in their scenarios, they are looking at three times more transmission grid in the US for the low end and five times more transmission grid for the high end. If we're going to have five times the grid capacity, we do not have anything. We don't have the copper we need. So that's like a critical material thing which has been identified and people talk about, but we also don't have the transformers. I talked to the head of Siemens Energy at COP 27. He said people call him on the phone and say, I want to buy Electrolysers for green hydrogen projects. He said, It'll take you one year to get the electrolysers. It'll take you two years to get the transformer to run the Electrolyzer. So call me in a year. This is old tech, not new tech. But there's a bottleneck. There's only very few companies that actually make transformers and make them with quality. So that's a limit. Same thing with things like microinverters. There's just not that many places that microinverters. There's not enough factory floors that make electric fuel cells like we don't have that infrastructure.

JF: [00:23:02] And so there's going to be escalation of price, there's going to be choke points and bottlenecks and supply chain concerns across the board. And there's also specialty infrastructure, things like CO2 pipelines, which we don't have. The United States has 5,000 miles of CO2 pipelines, which is awesome, way better than every other country in the world. To do the job, we might need 30,000 miles of CO2 pipelines. Well, that's infrastructure that needs to be built. That's class six wells that need to be approved. That's rights of ways that need to be permitted. That is steel that needs to be bought and put together by pipefitters. And the steelworkers, like we don't like. Again, the infrastructure itself is a problem. Same thing is true for hydrogen storage facilities. Same thing is true for ammonia storage tanks. We don't have the infrastructure for the clean transition yet. We have to build it. This gets me to the third choke point – permitting. There was a big kerfuffle around the IRAs passage because as part of it, there was going to be a vote on Senator Manchin's provisions for permitting reform. Everybody agrees that we need permitting reform. It simply takes too long and is too hard. That is everything from solar projects to housing installations to EV charging stations to CO2 storage sites.

JF: [00:24:17] The permitting takes a very, very long time. Offshore wind is the sort of the case in point for this. It takes a very long time to get an offshore wind permit done. Even if you do, it takes a very long time to get the interconnect on land done, which is a separate permit. To get a transmission line permitted across multiple states, typically take 17 years, like everybody knows that it's broken. We don't agree to what the solution is. In point of fact, there's quite a lot of discussion about what is the appropriate way and appropriate level to do that. It will probably require legislation far beyond what Senator Manchin had originally proposed. It will probably require a radical reimagining of what permitting for projects looks like in the US. At the same time that we do that, we are now really aware of questions of environmental justice and climate justice, the risks to disadvantaged and frontline communities. Correctly, people are trying to incorporate that into the permitting

process as well. We have to be able to do that as well as permit these things much more quickly, much more comprehensively. So it's a very tall order. We're not configured right now in the United States to do that.

BV: [00:25:27] Sounds like these are problems we can think through and plan towards. Julio just talking about, diving a little bit more into the infrastructure bottlenecks that you mentioned, and considering global supply chains today, I did want to ask, as you think about the global climate policy landscape, I know Europe has taken the lead. We've seen quite a bit of policy out of Australia as well.

BV: [00:25:53] And now we see the US coming out with some really meaningful policy. As you think about where we go from here, what do you see in terms of the US moves potentially catalyzing further movement in other policies globally, and who do you think will be the, you know, the most impacted and maybe spurred to move forward by this US regulation?

JF: [00:26:15] So Europe had been in the lead and then with the combination of the IJIA and the Infrastructure Reduction Act, they realized how far behind they were. Frans Timmermans, the head of the European Commission's energy transition group, Ursula von Leyen, who runs the European Commission, have announced a set of new measures to try to balance and better compete with the US measures, which is very welcome. But they're now playing catch up, which is nice because you want to create this virtuous cycle where countries are competing to have the best climate policies and the best manufacturing with it. In that context, a couple of countries were already pretty far ahead. I would mention first and foremost, Japan, which had been investing in clean tech for a very, very long time and has both supply laws and demand laws. So many of their power sector changes will require them to use ammonia in the power sector as a clean fuel. They are buying long term supplies from all over the world that is creating supply chains in Chile and Namibia and the Gulf States and India. And all of these countries are now getting into hydrogen to sell to Japan in the form of ammonia. China, of course, has always been big in their industrial policy for clean tech.

JF: [00:27:33] They're making a big push on hydrogen, on fuel cells, on batteries, on nuclear, on all of these things. They're going very, very big and very hard, in part to claim access to the global market. But this has created an awareness of the supply chain shortages for critical materials. The United States, thankfully, is stepping up. One recent example, it looks like we're going to open a lithium mine in Nevada. That's great. Like we are probably going to be opening other kinds of mines, perhaps uranium mines, perhaps copper mines. Again, people will have to see how communities in these areas respond. Not everybody wants a rare earth element mine in their backyard, but we need the supplies. In particular, we are seeing many countries like the Congo or Chile expand production in Australia. As you said, they're going very, very big on the minerals production as part of what they're doing. Last but not least, as part of the supply chain issues that you identified in the demand that the IRA creates, we're seeing a lot of factory floors opening everywhere. Some of that's in the US because 48C, which is one of the tax provisions in the IRA, gives you a non-dilutive capital to build new clean tech factory floors or to rebuild existing ones.

JF: [00:28:49] So that's great. But we are seeing again, fuel cell companies sprouting up in Denmark, in Germany, in Electrolyzer, companies in Japan and Korea. Like we're seeing all of this stuff coming forward. And that's true as well for novel solar plants, for efficient vehicles, for everything. And those factory floors, again, countries want them. So there is becoming now a bit of a competition around that. I expect we're going to see a carbon border adjustment come out of Europe to try to protect their own industries. It's not clear how well that will succeed.

We're seeing a lot of money coming out of Saudi Arabia and the UAE and Qatar. To get into these markets, they have the ability to move quite fast and they're driving innovation. They're building factory floors. They're making steel and aluminum production. All of this is kind of new. So the landscape is really dynamic and it's really exciting. But who's going to win is really an open question. I think a handful of nations will benefit from being aggressive on innovation and aggressive on infrastructure and aggressive on investment. And if you bring the innovation, the infrastructure and the investment together in one place, you've got a compelling business case for a long time.

BV: [00:30:07] Well, we're certainly very excited about it. And I really appreciate the thoughtful discussion around the changing opportunity set that's going to help to catalyze the movement to net zero, but also keeping in mind the bottlenecks, the additional resources needed, like, as you mentioned, human capital and also a number of pieces of infrastructure that are needed, as well as the additional skill sets needed to really tap into this funding. So very much appreciate your insights here and I think we collectively remain very excited about the opportunity. I'll turn it over to Maribel to close us out.

JF: [00:30:39] Thank you so much, Bhavika. It has been such a treat to be here.

MY: [00:30:43] Thanks, Bhavika. That does it for this episode of RPM. Special thanks to Bhavika and Julio for providing an overview of IRA and insights into how this legislation is likely to impact the global climate policy landscape. For more research and information on Responsible investing at Stepstone, visit us at stepstonegroup.com. RPM is available on Apple Podcasts, Spotify, Stitcher, and other podcast platforms.