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### Carbon Frontiers | Episode 4

Svenja Telle, Director of Origination, Base Carbon

We continue our Carbon Frontiers series with Svenja Telle, Director of Origination at Base Carbon. SmarterMarkets™ host David Greely sits down with Svenja to discuss the vital role of carbon removal in achieving our global emissions reduction targets. Together, they cover the strengths of technology-based carbon removals, the importance of community engagement and co-benefits in project design, and the need for transparent and scalable MRV solutions to ensure the quality of carbon credits.

As the market continues to evolve, it's becoming increasingly clear that market maturation relies on improved MRV capabilities and project quality to build trust, quantify results, and guarantee the quality characteristics of carbon projects and their resulting credits. Svenja and David map out the range of opportunities in climate finance and carbon investments, discussing how these investments not only facilitate our transition to netzero, but also mitigate climate and operational risk while improving organizational strength.

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**Svenja Telle** (00s):

As we scale this market and more projects come in with different technology approaches, or approaches in general, to both reduce and remove carbon from, let's say, biochar, direct air capture, both sequestration and CCUS, all of them have their own risks and potential shortfalls. And we need to be proactive about establishing the infrastructure needed to measure process on the project level, while shining light on the blind spots through data intelligence and technology solutions. So the bottom line here is that different project types need different ways to define and guarantee quality.

**Announcer** (41s):

Welcome to SmarterMarkets, a weekly podcast featuring the icons and entrepreneurs of technology, commodities, and finance ranting on the inadequacies of our systems and riffing on ideas for how to solve them. Together we examine the questions are we facing a crisis of information or a crisis of trust and will building Smarter Markets be the antidote?

**David Greely** (01m 06s):

Welcome back to Carbon Frontiers on SmarterMarkets. I'm Dave Greely, Chief Economist at Abaxx Technologies. Our guest today is Svenja Telle, Director of Project Origination and Technology at Base Carbon. We'll be discussing what high quality means in today's voluntary carbon markets, what role measurability must play to prove whatever quality a project claims to have, and how all of this will look for more novel carbon removal approaches, including direct air capture. Hello Svenja, welcome to SmarterMarkets.

**Svenja Telle** (01m 37s):

Thank you Dave for having me today on SmarterMarkets. I'm very excited to be here. This podcast is actually how I found Base Carbon. So in a way, you are my recruiter in disguise so this is full circle. I love it.

**David Greely** (01m 51s):

Well, we're very glad you found your way to Base Carbon and I'm really glad you're here today because I wanted to discuss with you using technology-based carbon dioxide reduction in removal projects to help meet net zero goals. This is certainly work that's on the frontier of the carbon markets, which you know, have largely been dominated by nature-based projects to this point and base Carbon has been investing in nature-based carbon reduction projects like Cook Stoves, and your role is to extend that investment, as I understand it, into more technology-based approaches to carbon dioxide removal, including direct air capture. So I'd like to begin with your perspective on these technology-based approaches. Where do you see the investment opportunities and where do you see the risks?

**Svenja Telle** (02m 39s):

All right, so I'm not going to throw too many numbers around today, especially after net brilliant episode from last week, which was an absolute treasure box of market data thanks to Bloomberg NEF. But I really want to ask the audience to take just away one number from this week's episode. If it's one, it should be this one. By the year 2,100 saw in about a little bit more than 80 years from now,

depending on how fast we start reducing emissions, the carbon removal industry will have to deliver up to 1000 billion tons of negative emissions. So for context of scale, that is almost half of all that already has been emitted since pre-industrial times. So when we talk about carbon negative infrastructure, we are not just talking about an investment opportunity in the trillions, but a multi-trillion dollar investment need. So one more caveat, engineered solutions will be increasingly important in the second half of the century to stay below two degrees Celsius, not even one and a half degrees as it was originally intended by the Paris Agreement, but two degrees, they must grow at least 1,300 times by 2050.

**Svenja Telle** (03m 51s):

So the next decade of deployment will be crucial for creating that momentum and their sort of first really hyping it up for further cost reduction and key mass adoption, but enough depressing numbers for now. Let's talk about the fun stuff, how we can get there. So I would say as of now, technology-based removals have a certain, let's say, hype about them, and yet there's very little understanding and the broader marketplace and amongst investors. So let's start with the basics. How does that sound.

**David Greely** (04m 24s):

That sounds perfect.

**Svenja Telle** (04m 50s):

So the good news is that technology-based carbon removals do not rely on photosynthesis for CO<sub>2</sub> capture or the biosphere for carbon storage and are therefore extremely scalable and quantifiable. I would say one something I focus on a lot in my work is it's direct air capture, which I consider one of the most scalable technologies out there and when we talk about direct air capture, there is not just one technology pathway. We are already talking about five to six different technology pathways so far and we are only getting started. So each of them has different maturity levels, challenges and risks, but I'll get into that in a little bit. Bad news is, well, I wouldn't call it bad, but something to definitely consider right now is the price point of carbon credits and of course the energy demand to run those technologies at scale. Currently, those are both very high prices right now for, for Dan Carbon credit go above 300 to \$600 per ton. And we even see projects where it goes up to a thousand dollars and more. The prime example here is climb works with the first commercial plant in Iceland called Orca, but estimate suggests that that cost will decline as the technology is scaling.

**Svenja Telle** (05m 46s):

And there are expectations that a ton of carbon from di capture is gonna drop below a hundred dollars per ton by 2030 or earlier. So I would say as a sort of general rule of thumb here is that 30% cost decline will happen with every doubling of the technology capacity on any given technology pathway. So we can expect the same to happen in direct air capture, but coming to risks and investment risks and also strength of those technologies. I will say generally speaking, DAC will have a play in a very important play in meeting net zero targets, both as a key carbon removal approach and as a source of climate neutral CO<sub>2</sub>, which is needed to produce many different things in our industries such as fuels and other products that require any source of carbon. And coming to a very interesting scenario of the International Energy Agency, they are counting on supplementing the decarbonization pathway with DAC with direct air capture.

**Svenja Telle** (06m 53s):

And according to their scenario by 2050 Direct Air Capture will scale to capture almost 60 megatons of CO<sub>2</sub> by year. So in terms of risks, what we are dealing with in order to get there within, well, it's 2023 right now, seven years. That's what we really need to address. We need to face the fact that we are dealing with nascent technologies with high technology risks and a lot of those technologies are still in their R&D stage and require very, very risk taking patient funding. The Tech ecosystem is also very fragmented, which makes it very complex to understand and they're not too many people out there yet that are thinking about this deeply and in full capacity in comparison to let's say, nature-based solutions. Also, a lot of those projects have a very high CapEx and OpEx and especially for sequestration infrastructure and the huge projects that we are currently seeing in the market, we are also seeing modular size decks, which I'm gonna talk about a little bit later.

**Svenja Telle** (07m 59s):

From the regulatory side, we see both, we see strength, but also risks in terms of, especially in Europe, there's a lot of discussion around permanent carbon sequestration, especially terrestrial and a lot of the carbon will have to be shipped up into the Nordics to be sequestered under the ocean coming to the global carbon market. There is a lot of uncertainty there too because the UNFCCC coming back to the Paris agreement still hasn't defined the role of technology-based carbon removals and carbon removals in general under Article 6 and the same applies to countries national determined contributions, the NDCs in which often the role of technology-based carbon removals is undefined. Well, should we also talk a little bit about the strength.

**David Greely** (08m 51s):

I think so, because that's a lot of risks. It's a lot of risk. It sounds expensive and risky. So tell me about the strengths.

**Svenja Telle** (08m 58s):

Well, I would say the highest strengths or the biggest strength here is that we need it. There is no way around it in order to achieve the carbon removals that are required under the Paris Agreement and the IPCC reports and technology based carbon removals deliver high quality carbon due to scalability, permanence, measurability, and their immediate, another good strength of those technology-based removals is that they have very low land requirements. So when you think about reforestation projects or mangrove projects, you require large chunks of ecosystems with technology-based removals. The land area is usually very concentrated and very small. Another huge strength and we are gonna talk about that later, it's the possibility to deliver very, very transparent MRV, which stands for measurement, reporting and verification and the regulatory frameworks are currently very in favor of those technologies, especially here in the US I would say one of the things I'm gonna dive into as well today is a huge, huge potential of applying direct air capture into industrial downstream applications, which is fast evolving as, for example, CCUS write that on your sheet. It stands for carbon capture utilization and storage, which can really be a multiplier effect for those technologies.

**David Greely** (10m 28s):

Well, you, you've laid out so many important issues for us to dig into a little more deeply today. When I think, when I think about the engineered solutions or technology-based approaches that you've discussed, you know, obviously right now very expensive, a lot of risks around them, but as you said, we're going to need them going forward and as they scale, cost should come down and the technology should become better understood. But of course for that to happen, people have to start investing in them. You have to start scaling up and I'm curious how corporations with NetZero commitments that are really driving these voluntary approaches, how are they viewing these technology-based approaches, particularly in light of concerns over quality and in light of debate over whether they should be in setting or offsetting their carbon emissions?

**Svenja Telle** (11m 17s):

Yeah, that's a, that's a great question, Dave. I would say generally speaking, carbon markets are at a very important point right now with ongoing uncertainty about eligibility of carbon credits and how that might work in terms of green washing accusations and internal demand for decarbonization of their own operations. So over the last couple of years we've been in a rollercoaster, I would say, in the carbon markets. There has been a lot of enthusiasm in carbon markets and in 2021, just two years ago, prices went up, everyone, it was the heyday, everyone believed that the acceleration of NetZero commitments by corporates would really increase immediate demand for carbon credits and that happened after COP 26 when a lot, a lot of corporates signed up to the Glasgow Financial Alliance for NetZero SBTI sort of entered VCMI, all those corporate VCM initiatives really got on the stage.

**Svenja Telle** (12m 20s):

So it was, it was a great time, but it's also logical to assume that that corporates will need carbon credits on their decarbonization journey because abatements cost remain still very high in some industries and carbon credits provide a way to show climate leadership beyond just a credible decarbonization path without having to take on too much technology risk themselves. But I think one of the big drawbacks of especially SBTI, the Science Based Targets Initiative was the uncertainty how corporates, like what, what's the acceptable limit between decarbonization and the use of credits as well as whether credits can and should be used before a company reaches net zero or after. So generally speaking, we really see a shift from reduction credits, which is something like REDD+ or avoided deforestation and cook stove projects to remove a credits. So most technology based approaches, especially DAC, but also biochar, create removal credits.

**Svenja Telle** (13m 26s):

And those are really considered under most of the corporate offsetting strategies. So there's not just a shift in terms of a larger picture within the market, but also from reduction to removal credits working on the carbon removal side of the market. I see a lot of demand coming, but not enough supply on the backend because those, those projects are complicated. They're dealing with complex technologies and they don't happen overnight. So it's something we really need to be thinking about. To answer the second part of your question, insetting versus offsetting, well that is sort of my, my personal love story with the carbon markets it's something I'm thinking most about and it's probably also one of the most complex topics, especially at the intersection of insetting versus offsetting for novel technologies and I'm gonna throw a few more key concepts around here. It's basically just three things you need to remember.

**Svenja Telle** (14m 25s):

It's CCS, CCU and CCUS. I'm gonna explain what that means in a little bit but insetting with DAC can really address both scope one and scope three emission and it goes all the way upstream in supply chains, right to raw material decarbonization such as minerals, cement, or hard plastics in common manufacturing. So the first point here is, well what is CCUS and how is it different from other approaches. When we talk about DAC today, the prime goal seems to be a geological storage by default. Everyone talks about geological storage. That is CCS, carbon capture and storage. I call it the holy grail of the carbon market. And that's where we want to be in order to achieve durability 1000 year plus storage for carbon. But I see real world problems to square the technology at the factor we needed to by 2025, just following CCS by itself.

**Svenja Telle** (15m 28s):

So the way I see technology based carbon removals isn't a black and white technology pathway, even though what I just said, the mainstream solution currently discussed is permanent geological sequestration and again, don't get me wrong, we need it just like Ned said last week, everything needs to happen, everything everywhere, all at once and to add to that, the pure carbon storage site is very complicated. We are entering really the realm here of infrastructure finance, but with very high execution risk and price uncertainty. A few examples I can give is we are dealing on one hand with the technology, which is DAC in this case, but on the other side we are also dealing with injection well permitting, which takes a long time. Geological studies take a long time are very time intense and expensive and building the pipeline infrastructure to transport the carbon from a place that has optimal energy supply such as geothermal or waste heat to an optimal sequestration side isn't always easy.

**Svenja Telle** (16m 35s):

So I believe it's important to consider all pathways as the focus right now should be on scaling and providing technologies and this is unlikely to be in sequestration where the timeframes are too long, uncertainties are too high, and financing risks are very high. So coming back into the other two buckets of our three keywords is CCUS and CCU. Well, CCU stands for carbon capture utilization. One of the most historic use cases has been EOR, which is enhanced oil recovery, which I'm not gonna be talking about today, but I'm gonna be focused on CCUS. So I call that the downstream decision tree. You have your technology on the top level and then you can decide as a project developer what you do with it and in order to scale and prove upstream solutions, we need to focus on the technology itself, but we also need to understand the risks, the margins, and finding pragmatic ways to make those technologies easily financial.

**Svenja Telle** (17m 43s):

So on the downstream side, especially for CCS, I think right now it's the time, time to optimize regulations to identify geological storage sites, do the due diligence on the ground plan and permit the pipeline infrastructure. All of this will take time and right now we see a multitude of technologies that are being developed. They all have the potential to divert into all downstream pathways where the technology itself is unaffected. This is especially the case for direct air capture and the main reason I believe that CCU is valuable is to bring down extremely high capital costs for technology that has an operated at scale and has high risk while providing near to medium term industrial carbon storage solutions like cement, carbon fiber, plastic, and other petrochemicals and that's where we get to the in setting. So thinking about how you can use the technology that removes carbon all the way upstream, and then when you as a corporate in a hard to abate sector come in and you can inset that capture carbon in one of your raw materials, that is I think a very interesting near term solution to prove the technology on commercial scale

**Svenja Telle** (19m 06s):

And I'm all about collaboration, so I think we should think about both and find solutions together, but we need to do it quickly.

**David Greely** (19m 16s):

Yeah, and one of the important places where collaboration I think will be needed is between the private sector and the public sector between the corporations and governments, particularly as it sounds that many of these technologies are still really in the development stage and often before they can become commercialized, they need to be proven and often government dollars are helpful in doing that underlying research funding, the underlying research and helping the, the market initially start to scale and so I'm curious, you know, when you look out, how do you see governments approaching this and are they starting to provide the funding that can help these new technologies scale up?

**Svenja Telle** (19m 54s):

Yes, it's a very important point. Coming back to what I said earlier, we are far away from, not far, but we are away from commercialization for a number of those technology pathways. So for governments to come in and show initiative, to really back that first push to bring technologies to commercial scale, we're seeing several initiatives, especially here in the US I was actually lucky to work under one of the RFIs for the DOE to submit and suggest geological storage sites, which prove that I'm not against geological storage submitted to the DOE to scope several geological storage sites for one of their several intended DAC hubs, which is currently being developed in the US each of the hubs is gonna have a capture and a sequestration capacity of at least 1 million tons. So coming back to your question the biggest player in the market right now from a government perspective is definitely the US.

**Svenja Telle** (21m 05s):

A lot of that falls under the US infrastructure bill, which has several different pathways. One of them was the direct air capture hubs that are being developed across the country, which is an interesting approach between CCS and CCUS. So it's optimizing for geological storage, potential energy supply, clean energy supply, and also integrating industry that can utilize and store the captured carbon downstream. One other interesting initiative is the 45 Q credits that also came out of the infrastructure bill. So coming back to the financiality of those technologies at the current moment, financiality is a major bottleneck and we really need to find ways to de-risk projects and I often talk about by diversifying revenue streams for those projects away from a pure carbon credit approach into different revenue streams. That's an easy, it's easier to find investment for project developers at a lower marginal capital cost.

**Svenja Telle** (22m 10s):

So let's think about how the equation would look like for CCUS project, let's say in cement where the carbon is downstream applied into cement up and for the building sector. How does that look like on the investment side. Well, we have our revenues for, for the carbon credits, that's one, but that's volatile. It's a very volatile price. We have the carbon itself, and depending on what you do with the carbon, those are very local markets because carbon transportation in itself is not very efficient. So carbon prices across local markets vary, but it's way more constant than the volatile VCM and then we have 45 Q tax credits under the infrastructure bill, which vary depending on what you do with the carbon between \$85 and \$180 per ton. \$85 is the lowest margin which you receive for EOR, that's enhanced oil recovery to £180 a ton for permanent sequestered carbon and we also see an increasing interest for technology-based carbon removals in the Middle East, especially in Saudi Arabia, the UAE and also Bahrain.

**David Greely** (23m 28s):

Those tax credit numbers are pretty eye popping, right, because you put that \$180 a ton against the cost of 300 or more, it might not seem that large still over half, but compared to many of the prices of credits, at least on the nature base side, those are still in the five to \$20 a ton range. So getting \$180 a ton credit is?

**Svenja Telle** (23m 51s):

Yeah, it's, it's pretty, pretty impressive and I would say that's also the first time that we really see a price point within the US. It's far from the, from the ETS, from the EUTS, but it's definitely a good signal for the market that, that the government, the legislation put a price on how much is it worth to permanently sequester carbon underground.

**David Greely** (24m 16s):

Right. I wanted to come back to a point you raised earlier when we were talking about corporates and this shift you had mentioned of a preference for removals as opposed to reductions. And I imagine that, you know, once again comes back to the idea of what is perceived as quality and what won't create risk of being in an unfortunate headline. And like along those lines, nature-based projects such as REDD+ have recently come under criticism with some arguing that the estimated baselines for how much deforestation would've occurred absent these projects were too high. So the estimated amount of carbon reduction and the carbon credits generated was too high. So this once again highlights the biggest concern in the voluntary carbon markets that whether those criticisms are right or not, you want the credits that you're buying to be perceived as high quality, you know, kind of bulletproof in a way. And so I wanted to ask you, where are we getting to on agreement on what high quality means in the context of the voluntary carbon markets and is it migrating towards removals away from reductions?

**Svenja Telle** (25m 26s):

Yeah, I love this question. It's something that is, complicated, it's very complicated. Well historically, the definition of high quality in the VCM has been difficult to come to a consensus to and the latest initiative in the market is their IC VCM, the Integrity console, the voluntary carbon market, which is actually a continuation of the TS VCM, the task force for scaling voluntary carbon markets. We see it a lot of tongue twisters on,

**David Greely** (26m 03s):

Yeah, I just say Kearney commissioner

**Svenja Telle** (26m 07s):

After working at the UN, you're used to a lot of weird cryptic language And another, another example is well coming back to the ICVCM, they recently came out with the CCPs, which are the core carbon principles, which is something like a legally binding market-wide initiative to streamline quality standards in the market. So that was, that's, that's a big one on there on the supply side, right. We need to understand the ICVCM is for the supply side, the VCM I is for the corporate side for the off taker side. And they also recently came out with the codecs for what quality means, what you as a corporate should be following if you want to guarantee that you are buying high quality carbon credits and I believe that from both sides, from the supply side and the demand side, it's becoming increasingly important to agree on a definition of what high quality really means, both in applicability and also in terms of willingness to pay for a quality margin because of growing scrutiny and public scrutiny and green washing accusations.

**Svenja Telle** (27m 27s):

So I would say market participants on both sides on the developing side or development side and the off take side are under a lot of pressure. And the market complexities and the lack of transparency and projects create a very difficult risk for corporations across all industries and what we just saw over the last couple of weeks with recent news, from what you mentioned, rags and baseline inflations, those corporates were trying to do the right thing and at the end of the day, they end up in the headlines as having done something wrong. So there is a huge reputational risk and quality standards and quality measures in the market I think can be a mitigation factor for corporates and also for project developers to mitigate that reputational risk. So in my opinion, high quality cannot stop with just the characteristics of the carbon credits. I mean it's all about additionality durability or permanence leakage and so on.

**Svenja Telle** (28m 31s):

But it also has to include the social implications of the project and we are increasingly talking about co-benefits such as social, educational, environmental, and economic. All those directly translate into quality of the carbon projects and in turn should reflect a higher price point for the credit but how do you measure it. So the problem is they need to be quantifiable and transparently reported, but those mechanisms are currently missing and it's very difficult to reach consensus and standards around them. One example is the Vera CCB standard, which sort of taps into streamlining and quantifying co-benefits, but it's still very difficult to compare across projects and I think we are at a point where we need to ask important questions around the social and community returns of projects and it's important to not dehumanize them. We really need to remember that we are working with real people on the ground and are being impacted by these projects.

**Svenja Telle** (29m 41s):

And that leads me to the point that we need more clarity on how benefit sharing mechanisms work behind the scenes. Who defines what benefits actually are for communities and that makes it harder to compare because those co-benefits and those community benefits have to be locally defined. Those have to be local decisions and cannot be generalized because every project is different and communities express different needs and desires how to benefit from the project, from the project intervention. So the way benefit sharing mechanisms are created and co-benefits are defined, doesn't just vary by region, but also by project type. REDD+ projects have very different benefit sharing mechanisms than reforestation projects, especially if you're working with small hold farmers and small hold landowners because suddenly you are not dealing with communities but with individuals and you need to decide and those individuals or communities need to decide how to benefit from the project and how the benefit is being distributed across either individuals or the community at large.

**Svenja Telle** (30m 54s):

I think what matters in this context is that local and indigenous voices are not just heard, but included to design the so-called Co-benefits of a given project. And it's also very important to guarantee that those identities are treated with as much sensitivity as other participants in the market. So we are often seeing that community consultations are happening on the ground, but without much data protection. At the end of the day, there's not much identity protection if you go upstream in projects, signatures are on clipboards, national ID cards are saved on computers without passwords, all those nitty gritty things where I'm very careful to not create an identity sensitivity double standard in this market. When we talk about upstream project development in communities, and I often get asked, and this is a very important point, if all this community work and co-benefits isn't more work for philanthropies or concession capital, well at a first glimpse, yes, but there is strong scientific evidence that community support and the project is one of the main

drivers for project success. So in turn, community engagement, happy, satisfied community becomes a financial risk mitigation intervention. When we are talking about hundreds of millions of dollars of investment, of course we want to maximize the project's success. Well, but in this instance, we need to take this seriously from both a financial and a moral and ethical perspective to not exploit communities in project areas and ensure that benefits are returned in a quantifiable, transparent and appropriate and fair way.

**David Greely** (32m 49s):

That's such a great point because I think people often think of those aspects as a nice to do or a charitable thing or the right thing to do, all of which it is the right thing to do. But as you said, it's also from a financial perspective and an investment perspective, the prudent thing to do in terms of making sure that the project's successful and I think all too often we value things we can measure, even though some of the most valuable things aren't easily measurable. And that brings me back to another strong interest of yours, which you mentioned earlier, which is MRV measurement reporting and verification. And I was curious, how does this enter into being able to assess and assure quality, like are the principles the same, whether it's a nature-based or more of an engineering based approach and what are the differences in application between the two?

**Svenja Telle** (33m 42s):

Yeah, that's a very great point and I always say you can only ensure what you can measure. So my big passion and this market is that we really need scalable and transparent ways to measure and report on project performance and not just quantifiable project performance in terms of carbon, but also the broader quality characteristics and we need smart ways to do due diligence on baselines, especially in REDD. But also it's important just like I said earlier with communities, it's not a one fit for all approach. Doing baseline assessments and due diligence in REDD+ projects, it's completely different than doing due diligence and MRV in, in EOR projects or in cook projects or on the technology based removal site. So what I'm interested in generally is finding ways to take MRV for the upstream and to create data points around those benefit mechanisms I just mentioned, to create ways to compare cross projects more broadly than just the amount of carbon credits generated.

**Svenja Telle** (34m 52s):

And this is a very pressing issue for me and people are actively thinking about this and especially the World Bank and the Climate Action Data Trust play a great role in this by really thinking about how to create digital solutions and thinking about digital solutions and MRV is really at the frontier here. We need to think about this, how we use digital solutions for data transparency, traceability, because it will be crucial moving forward as data architecture becomes increasingly complex and the number of projects being registered is rapidly scaling. So as the number of projects grows, we also need scalable and more intelligent MMRB solutions for a diverse set of projects in the market. But my point is that as we scale this market and more projects come in with more different technology approaches or approaches in general to both reduce and remove carbon from let's say biochar capture, both sequestration and CCUs, all of them have their own risks and potential shortfalls.

**Svenja Telle** (36m 03s):

And we need to be proactive about establishing the infrastructure needed to measure process on the project level while shining light in the blind spots through data intelligence and technology solutions. So the bottom line here is that different project types need different ways to define and guarantee quality. I can give some examples for forest nature-based projects. This is where we really have seen the most so far innovation in the market for, for MRV and some of the prime examples here are pajama and Vera, both companies that are utilizing machine learning and LIDAR technology to improve measurability and reporting of those projects, which is easy for rent, but more difficult for, for reforestation, especially aqua forestry projects or reforestation projects with the vast species variety. Because on a red level you are measuring standing trees on an ARR level, on a reforestation level you start with little saplings.

**Svenja Telle** (37m 10s):

So generating data points for reforestation projects within the foreseeable future, I still see that it needs to be combined methods of manual MRV, especially in the early stage of the project and then later on, geospatial and LIDAR technology can take over. Another big discussion in the market is the cooktops cooktop projects. It's a project type that is extremely attractive for investors as the timeline is shorter. When we talk about ARR and REDD projects, we're talking about 20 to 30 years cooktop projects are generally running for 10 years. And I just came back from Asia where visited several cooktop manufacturing facilities with one of my favorite developers in the world, which is BNB advisory and saw very interesting MMRB solutions on the ground. So traditionally MRV for cook stoves has been manually through sampling on the ground sampling as the project progresses, but by supplying higher grade stoves and including sensor technology, heat sensor technology and data transmission technology, slowly but surely there are several pilots around the world where we see immediate life data or at least once a week and so on, about the usage and the utilization of the cook stove.

**Svenja Telle** (38m 36s):

So thinking about how data monitoring can really counteract for inflated baselines because you have the proof right there, that's why I so strongly believe in technology advancement with an MRV for, for a set of different project types because a lot of the scrutiny is valid. But on the other hand, it's also important to remember that projects and especially cook stoves can be extremely valuable when conducted with integrity, not just from a carbon perspective, but also for social and health benefits, especially for women as they're often responsible for the cooking and also for harvesting the biomass needed for the cooking. So finally, nevertheless, the project type MRV and quality are always interlinked and I promise I'm not gonna throw away too many numbers, but here's one more. According to BBCG, 91% of buyers rank MRV as one of their top priorities and credit purchase decisions and dissatisfaction with m MRV is one of the top sources of market friction. So from a corporate perspective, we see a trend towards more auditing of projects, they're educating themselves more and more due diligence on project level before purchases are made and as a takeaway, MRV is an overarching need for each of the project types in different capacities and pathways in order to first increase trust, second quantify results, third, build credibility, fourth guaranteed quality characteristics of projects and carbon credits and lastly, to create comparability and fungibility in the market.

**David Greely** (40m 29s):

Yeah, I find it really interesting in this conversation because on the one hand we're talking about, you know, really kind of cutting edge technology where there's a lot of experimentation and development and a need to scale very rapidly, as you said, to get to where it's useful within seven years you know, by 2030. On the other hand, there's the need to build trust, the need to build consensus and how we measure and report and verify and that feels like a very slow moving process. So when I kind of look at what you're doing, I see you being in a position where you're required to bring tech space dynamics, you know, minimum viable product, move fast and break things ethos into an area that's inherently slow moving because it does require a lot of consensus building and validation and I'm curious, how do you walk that line where you're conventional enough to be in compliance with currently accepted approaches, but where you're also doing something new and innovative?

**Svenja Telle** (41m 31s):

Yeah, it's, it's complicated. I said that before, right very much and I'm not even kidding about that. Well, we need to create transparency in the market and understand real tangible impacts, meaning what carbon removals are actually happening on the project level and one real pitfall here is the lack of methodologies available on the technology-based carbon removal side of the VCM, which might fragment the market even further into arbitrary self-certified carbon projects with very opaque technology risks and delivery uncertainties. So one of the largest challenges in bringing technology-based removals to the market at scale is that I would say one of the largest ones is really the unavailability of methodologies for project developers. Let's say you are a project developer and you're in need of finance and your main revenue source are carbon credits, but you don't have a methodology to register your, your project under, what do you do?

**Svenja Telle** (42m 41s):

It's a huge bottleneck, and I'm gonna talk about this a little bit more, but for now, coming to the second point, you need finance and it's very hard to access finance right now for technology-based carbon removal companies as their VC model is often not sufficient. Their timeline here is too short. We need capital commitments that at least 10 years long through project finance and structured finance approaches, we saw a very good attempt in the market, which was the frontier fund, which was really what we are talking about addressing carbon frontiers in the market by providing project finance to a certain extent but again, the commitment, the capital commitment was too short. I think it was only seven years and we really need patient capital of at least 10 years because at the end of the day, for the technology provider who otherwise gonna carry the, the tail risk of the last three to four years of the project life cycle, if you only have capital committed for the first seven years.

**Svenja Telle** (43m 49s):

And one big thing that I think is very interesting is that a lot of those projects, because out of need, are financed through forward purchase agreements or off take agreements and we're dealing with a lot of technology risk. So we are having no way to register the projects under a methodology from one of the largest standards. We have difficult access to patient capital. So project developers are in the situation where they accept capital from forward purchase agreements even though there's a very high delivery risk and that risk is something we currently don't understand. We don't know how high that is. What is the certainty that the forward purchase agreements, the currency of the transaction, which is the carbon credit, is actually going to be delivered.

**Svenja Telle** (44m 55s):

That can be very risky, especially if it's self-certified. And we see an increasing amount of players in the marketplace in the VCM, the trade technology based carbon removal credits from projects on marketplaces or exchanges that had no way to register with a standard as the methodology doesn't exist yet. So thinking about self-certification, again, it's very risky, especially when it's through forward purchases and the lack of MRV and methodologies for a lot of those novel technology-based removals requires a lot of manual due diligence, which is time intense. There is not enough subject matter expertise in the market, and it requires deep understanding of techno economic studies for each of the technology pathways and a lot of their downstream applications as well. It becomes even more complex if you have five technologies and each of them can downstream apply the carbon, let's say, into X number of industrial downstream applications.

**Svenja Telle** (46m 00s):

From lifecycle assessment perspective of the carbon, each of them is different. So we are getting in really uncharted territory here, but keeping in mind that the vast majority of the carbon credits on their, on the carbon removal site are currently not delivered. So we are talking about, I think around 90% of non-delivery as of today. So we have a big bubble in the market where we face high risk if we don't have a way to measure performance and identify techno economic risk factors. So my takeaway here is it's, as I said, it's very complicated. We need agility, we need registries to be more agile, and we need those methodologies for project developers to do the right thing, to walk the golden path. If you want to deliver high quality carbon credits on the technology based site that needs to be in place, that market infrastructure needs to exist. And we simply don't have time two years, which is usually the life cycle for one of the major registries to come forth with the methodology to wait that long. So I, really wanna give a shout out to some of the registries like Poorer Earth that was recently just endorsed by ACURA, that are really more on the edge of, of technology-based carbon removals and can serve as a very important player in the market to bridge this gap.

**David Greely** (47m 37s):

Yeah. So it sounds like we need to speed up the methodology creation cycle without losing credibility, which big challenge sounds like we need smarter markets for better measurement, reporting and verification, and we need people to get comfortable with significant risks, right cause it sounds like getting those investment dollars to flow, which is always, you know, most critical, it's still substantial uncertainties, as you said. You know, having to go into agreements where you don't know that you can deliver the credits that you're promising to deliver in 5, 10 years because the technology's not proven out or scaled yet. That's significant and so I'm curious as, as you look to kind of try to walk this golden path between moving quickly enough to be innovative and get the technology to scale to the place where it can have a meaningful impact on the transition in net zero, and at the same time moving slowly enough to bring everybody else along, build consensus, make sure that the technologies are proven out and de-risk before putting a lot of money in. How do you get investors and corporates with net zero pledges who I would imagine are quite risk averse to try to walk that golden path with you?

**Svenja Telle** (49m 00s):

That's the 1 million question, Dave. I would say educate, educate, educate. We need to map out opportunities and really present this as a way that most of these investments are not just good for the climate, but also generally good business decisions from a portfolio risk and ESG perspective that needs to be understood, especially the case of direct air capture and industrial downstream applications is the perfect marriage between carbon markets and ESG performance through in setting and potential offsetting through supply chain decarbonization, raw material decarbonization, and so on and so forth. So building mutual trust and understanding how carbon removal technologies can be applied to broader problems around supply chain decarbonization and therefore raw material decarbonization can be weighed with involve risk-averse investors. Right now we see strong engagement from several tech giants, such as Microsoft and the deck space, which is very promising, but off take volumes are very low and purely for offsetting, not for insetting and industrial downstream application.

**Svenja Telle** (50m 15s):

So as I said earlier at the moment, a pure carbon offsetting approach comes with a high price tag. But I hope that more cross-sector collaboration can happen, where historically conservative industries such as mining and construction, see the potential for strategic investments in DAC to change the dynamics of their own supply chain and to ease the burden on their own carbon footprint. So I guess as a closing thought, rather than ending this episode with the conclusion, I want to end it with a story from the field because that's what we remember throughout the last 15 years working on climate change issues at and during my PhD research here in Hawaii, I was very fortunate to learn from indigenous communities and saw how different ways of lives can be bridged through a common goal

protecting our ecosystem. And more than 10 years ago when I worked on climate finance integrity mechanisms, we worked with indigenous communities in the Amazon on training them to use drones to monitor legal logging.

**Svenja Telle** (51m 32s):

That's more than a decade ago. It was amazing. They became stewards of the forest within rat plus projects using technology that before that wasn't available to them and at the end of the day, increased monitoring efficiency of the entire project. Another story from the field, which I absolutely love, is just, just a few weeks ago, I visited an agro forestry site in a deserted region of rural India where access to water is at the heart of the project. We were in a desert and I asked, how do you find the water and I was amazed to hear that it's through traditional ecological knowledge of tribal communities. Their so-called water finder suggested 35 well sites, and he was right 32 times. That's statistically significant. My own experience throughout my career is that traditional knowledge is brilliant and we need to listen and integrate it in both project design and MRV.

**Svenja Telle** (52m 28s):

We cannot underestimate the communities which are often the host communities of the projects themselves and I want to stress that we need both nature and technology-based carbon solutions for our future as a species, as a people, and maybe technology removals can be a bridge to help collaborate across industries which historically didn't see synergies between them and I might add one last poetic and maybe sentimental note by saying that I deeply believe that as David Mitchell sets so eloquently, our lives are not our own. We are bound to others and present and by each crime and every kindness we birth our future, I hope corporate decisions makers can see that and hopefully by dedicating my life to tech-based removals, this can help birth the future in which climate change won't be an existential threat anymore. So I thank you very much, Dave for having me today, and I'm excited for futures of Smart Markets.

**David Greely** (53m 33s):

Thanks again to Svenja Telle, director of Project Origination and Technology at Base Carbon. Join us next week with our guest Peter Zaman. Peter is a partner at HFW in Singapore and has been practicing law in climate finance in the environmental markets since 2004. He walked us through the intricacies of Article 6 last year, and in his next episode, he's gonna bring us up to speed on what's changed and what hasn't and where we are now. We hope you'll join us.

**Announcer** (54m 00s):

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**Announcer** (54m 39s):

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