Transcript from CMI's Carbon Conversations event on Carbon Capture and Storage (CCS)
Held Friday July 23 2021
Panel: Melanie Ford, Head of Method Development, Clean Energy Regulator, Dr Matthias Raab, CEO, CO2CRC, Mark McCallum, CEO, Low Emission Technology Australia (LETA) with host John Connor, CEO, Carbon Market Institute.

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John Connor: Well, good afternoon once again, and welcome to Carbon Conversations. As we said in our promo, the lockdowns are back on, so Carbon Conversations are back on. We have had to postpone our Summit again, it will now be the 9th and 10th of December, you will all be vaccinated by then! I would like to acknowledge the country from where we are all being represented here today, I'm here speaking to you from Gadigal land, and I pay my respects to Elders past, present and emerging.

John Connor: It's great to have you all here today, there's been significant interest in this topic. It's timely, with a variety of developments in the background. Our primary focus is to have a look at the method that's being developed by the Clean Energy Regulator, we'll start off with some comments and views from the team there at the Clean Energy Regulator, and then delighted to have Matthias Raab from CO2CRC and Mike McCallum from Low Emission Technology Australia joining us as well.

John Connor: We'll take questions, we'll moderate those, ideally please put questions in the Q&A, makes it easier for me to look at. If you've got broader commentary, feel free to put that in the chat, I will moderate those questions to the best extent that I can. Without further ado, perhaps I can throw to Mel Ford and the team there at the Clean Energy Regulator to give us an update on how the method is progressing and how people can participate.

Mel Ford: So thank you John, and thanks for your opportunity to speak to you today. My name's Mel Ford. I head up the method development branch here at the Clean Energy Regulator, and I'm joined today by Megan Surawski and Patrick Passey, who are the key people developing the CCS method from the regulator. Before we dive into the details of the CCS method, I thought it was worthwhile talking a bit about the Emissions Reduction Fund and what the role of a method is under the scheme. As I think most of you know, the Emissions Reduction Fund is a voluntary scheme. That's run by the Australian Government and provides incentives to businesses, land holders, and other project proponents to undertake activities to reduce emissions or sequester emissions preventing their release into the atmosphere. To participate under the Emissions Reduction Fund, your activity needs to be covered by what we call a method.

Mel Ford: These methods or methodology determinations, are legislative instruments that set out the rule book you need to follow in order to undertake your project. They set out a criteria around things like eligibility, how to calculate net abatement and how to run project activity. Once you've registered your project with the Clean Energy Regulator, and we've been provided with assurance that the activity has been run in a way that's

consistent with the method, you can then earn Australian Carbon Credit Units (ACCUs). ACCUs represent a ton of emissions avoided or sequestered, they have a monetary value. ACCUs can be sold to the Australian Government through our auction process. And our next auction is on the 13th and 14th of October this year, they can also be sold to the secondary market.

Mel Ford: It's important to understand that the methods are assessed by the Emissions Reduction Assurance Committee. This is a committee that's independent and has been set up to assess the methods against the Offsets Integrity Standards. They are a key control to ensure the integrity of the Emissions Reduction Fund. The Offsets Integrity Standards have a range of criteria that all of the methods under the ERF have to meet, including that the method need to be evidence-based, that abatement calculations are conservative, that abatement can count towards our international emissions reductions targets, and really importantly, that the abatement is additional. That means that the abatement would only occur because of the incentive provided by the ERF.

Mel Ford: Before I hand over to Patrick and Megan to deep dive into the CCS method, I thought it was worth giving you what I think the key takeaway is of the CCS method. This method will allow Australian Carbon Credit Units to be earned for activities that capture greenhouse gas emissions and inject them and sequester them permanently in underground geological formations in Australia. We think that this method can play a really important role through providing incentives to a range of sectors to reduce their emissions, such as in the oil and gas sector and those facilities that undertake industrial process activities. In designing the CCS method, we have drawn on the existing regulatory and reporting frameworks within Australia. These provide the criteria that projects need to meet in terms of looking at things like making sure the site is selected appropriately, that the right approvals have been granted, and there are ongoing monitoring and recording obligations.

Mel Ford: The method has been designed to be technology neutral. This means that it can allow for a range of different greenhouse gas sources to participate in the method. And it also facilitates the emergence of what we might call a hub and spoke model. So you can envisage a CCS project under the ERF method that has a single greenhouse gas source and a single point of injection and sequestration. Or you could have a number of projects from different greenhouse gas sources that are injecting into a single point, so into a single hub.

Mel Ford: I spoke earlier about the Offsets Integrity Standards and the need for the abatement to be conservative. In designing the abatement calculations under this method, we've designed them so that you get credited for what you capture minus the project emissions. So that effectively means that the abatement is a function of the amount of greenhouse gases that are captured and stored minus the emissions that are associated with running the project. Patrick will talk further about this in a moment. In developing the method, we also sought expertise from people that had experience in understanding the behaviour of greenhouse gases when they're stored underground. The advice we were given was that the risk of reversal was very, very low. It's a very low

probability event. Nonetheless, the method does have additional controls for that, that Megan will take us through. The draft method and a simple method guide that outlines, in lay persons terms, how the method might work is available on the DISER website at the moment. We're really interested in seeking feedback on the method and in particular, whether it is fit for purpose. I'll hand over now to Patrick to take us through the method.

Patrick Passey: Hi, my name is Patrick Passey. I'm the assistant manager within the team developing the method, and I've had the pleasure of being the operational lead in the development. Before I get into a little bit of the detail about what the method, is I want to provide a bit of a snapshot of how we got to this point. I know CCS has had a long history in Australia and around the world, but in terms of the method, we started in February, 2020, that's when things really started to kick off in terms of this method. This is when the King Review report was released. This was a report from an expert panel, they were tasked with coming up with advice on abatement solutions.

Patrick Passey: They recommended the development of the CCS method, that recommendation was accepted by the Government and our colleagues over at the department of industry. We then commenced scoping work on a CCS method in April, 2020. Fast forward six months and things really kicked into gear with the Low Emissions Technology Statement, which I'm sure many of you are familiar with, it recommended five priority technologies for the government, including setting a stretch goal of $20 per ton for CCS. Alongside that the Government then agreed to develop a CCS method within 12 months. Shortly after that, the method development function moved over to the Clean Energy Regulator. We subsequently undertook targeted technical consultation workshops through December and March. That brings us to where we are now, at nearly the end of July, 2021, with the proposed method up for public consultation and we are very keen to read what people think of the method.

Patrick Passey: I now want to dive into a bit of those details and set the scene. I want to highlight a few key features of the method. The first of these features really goes to the heart of what a CCS project is, what it is that defines a CCS project in terms of our method. We contemplated a few different approaches for this. We thought about defining it by reference to the storage site or defining it by reference to the storage site license or these kinds of options. In the end, we settled on defining it by reference to having a new greenhouse gas source. Putting it another way, the decision to go ahead with a project, it's really the decision to capture emissions from a new greenhouse source for permanent storage.

Patrick Passey: The reason for this is that it really enables what is commonly referred to as a hub and spoke project. For those of you who aren't as intimately involved in CCS, a hub and spoke project is a CCS project where you've got the hub, the central storage site, and each of the spokes represent a different source of greenhouse gas. You might have multiple facilities all feeding gases in to the one storage site. This approach enables reduced economies of scale of running a project. The key part of it is that each new spoke, or new source of greenhouse gas, basically gets a new project. Each new project

gets a new crediting period and I'll touch on crediting periods shortly, but the idea of this framing is that this creates an ongoing incentive to attract and set up new sources of greenhouse gases to utilise an existing storage site.

Patrick Passey: The next key feature I want to highlight was one that Mel touched on before. A key aspect of this method is that it doesn't set out the operational mechanics of how a CCS project needs to run. Already around the country we have a range of regulatory frameworks that set out detailed rules for how CCS projects need to be run. The list of existing frameworks is there, and these will vary slightly around the country, but all are relatively similar. They set up aspects such as site selection, monitoring and verification, site closure. All of these things are designed to ensure the permanent storage of the injected greenhouse gases. One thing that came clear very early on in our development work is that we didn't want to develop and overlay, our own requirements on top of that.

Patrick Passey: So rather we've ended up leveraging off existing frameworks, and it's a requirement within the method that the project has to either utilize one of the existing frameworks or meet criteria set out in the method if they want to meet a different regulatory framework. The final point is the proposed CCS method, like other ERF methods, leverages off the existing national greenhouse and energy reporting scheme. This has a couple of benefits. Again, it avoids duplication, and it ensures the abatement that we generate from the method is consistent with Australia's carbon accounting and is consistent with our international reported emissions numbers.

Patrick Passey: The next slide touches on crediting periods, and how the abatement itself is generated. At the starting point, and you can see the proposed method includes a 25 year crediting period, and this is consistent with the other biological sequestration methods. For those who aren't as familiar with the ERF, when I say crediting period, a crediting period is the period in which a project can receive ACCUs, which is essentially a financial return for the project. A key feature of methods including this one is that they set out how the abatement is calculated. Then in simple terms, the calculation of CCS abatement isn't that complex. It can be thought of as simple as the amount of greenhouse gases injected into the ground minus various project emissions, this becomes a little more complicated in the method itself, we've framed it as the amount of greenhouse gases captured from each greenhouse gas source.

Patrick Passey: The method also includes various apportionment mechanisms to allow for those hub and spoke projects where you might have multiple projects sharing the same compressor or sharing a pipeline. You need to apportion emissions between those different projects. When I talk about project emissions, I thought it was worth highlighting perhaps a couple of the larger ones. Those are captured in that top dot point. These are firstly the emissions from the capture process itself. This is the actual mechanism or the piece of equipment that captures the emissions within the facility and for some projects, and for some industries, this will be a larger number than others. The other thing worth touching on is the processing and that's largely compression of emissions so that can be large. These are the emissions required to take the gas and

compress it down into a liquid form. It can then be put into the pipeline and sent down to the storage site. The final dot point there is the additional deduction, control for that risk of reversal is how we frame it. That's a good segue over to my colleague, Megan, who's now going to go into more detail. Thank you.

Megan Surawski: I'm Megan Surawski. I'm the manager of the method development team that's looking after the CCS method. I get to talk to you about the exciting world of risk and reversal. A key feature of the method is an approach for managing the risk associated with any of the injected greenhouse gases escaping to the atmosphere. This risk is called the risk of reversal. That is the carbon abatement that was stored or delivered is lost or reversed. Now, while this risk is considered low in Australia due to the variety of robust regulatory frameworks, as well as the geological formations that are candidates for CCS, there is still on the balance of probabilities, a need for some risk controls. With this method, there are two types of risk controls.

Megan Surawski: One is during the crediting period, so that any loss of the injected greenhouse gases are deducted from the climate abatement. Now expert advice that we've received during the consultation process, as well as other external advice, indicates that the risk reversal is greatest during the injection period. As a result, the equations account for this, the second form of risk of reversal that the method controls for is during the post crediting period. The method has an extended accounting period. During this extended accounting period, project proponents will be required to report and monitor any potential losses or escapes from the site. Now we've set a 3% withholding buffer for accounting for this risk. This risk is for the carbon abatement because the regulatory frameworks don't account for that. And it's to protect the carbon credit integrity.

Megan Surawski: The withholding buffer, that 3%, it's withheld during their accounting period. It continues to be withheld during the extended crediting period, but a project proponent can seek to claim that back at the point of when the injection license is surrendered, now the surrender of the license is considered a return event. That is when the project proponent goes to the regulating authority and seeks to have their liability for the site be transferred to the jurisdiction regulating authority. At this point, the regulating authority seeking to sign off on that checks that the site is stable, that it is secure, and that it is willing to take on the risk associated with managing the site and the permanent storage, it's essentially that there's confidence that it is now permanently stored. At that point, the project proponent can seek to then have that withholding returned to it from the CER. I can hear you all thinking why 3%, the agency did seek expert advice, reviewed a range of other international frameworks which vary, between methods that have no buffer up to the Californian protocol, which sets a withholding buffer of up to 16%. It was thought that 3% was reasonable in the circumstances.

Megan Surawski: There are two exclusions that are covered by the method. The first is direct air capture. Now direct air capture is a nascent technology, a very exciting technology that directly captures carbon dioxide from the atmosphere for permanent, geological storage. I guess you could call it a mechanical tree of sorts, but different to trees, there's currently no account within the national inventory or approach under international

accounting protocols that can allocate that type of abatement against an account. At this point in time, abatement from direct air capture cannot be used to meet Australia's international emissions reduction targets, and then a further exclusion is enhanced recovery, or enhanced hydrocarbon recovery. So enhanced recovery refers to the injection of carbon dioxide to recover the remaining hydrocarbons, be it oil, be it gas in a reservoir. This is outside the scope of the CCS method for a couple of reasons.

Megan Surawski: First of all in the early consultation period in 2020, stakeholders agreed that it was out of scope for the fact that it is complex, it would add a significant amount of complexity to the method, particularly in trying to ascertain the amount of abatement that would be associated. Another point to that is that it's unclear whether enhanced recovery or enhanced hydrocarbon recovery would deliver carbon abatement compared to the emissions associated with the combustion of the resulting extracted hydrocarbons. I'm now going to hand back to Mel on what happens next with our method.

Mel Ford: As we said earlier, the draft method is currently on the DISER website, alongside a simple method guide. The consultation period was a month. It does close next week. If you have a look at the method and provide a submission, I'd really encourage you to do that. After the public consultation closes, the Clean Energy Regulator alongside the Emissions Reduction Assurance Committee (ERAC) will consider the submissions that were made, and make adjustments as appropriate. And then it will be up to ERAC to decide whether or not the method is consistent with the Offsets Integrity Standards. They will provide a recommendation to the Minister, in terms of whether or not the method should be made. So that brings us to the end of our presentation. I'll hand back to you, John. Thank you.

John Connor: Thank you very much Mel, we'll come back to you, there's already a couple of questions there, if you have a peruse. I'll just go directly now to Matthias Raab, the incoming CEO of the CO2CRC, interested in your views, a bit bigger picture, but also in relation to this method.

Matthias Raab: Thank you very much, John. Yes, I'm still the chief operating officer of CO2CRC and the incoming chief executive from August and I've been with the company for over 10 years. CO2CRC is a not-for-profit collaborative research company. We are focusing on blue sky research up to commercially relevant demonstrations of carbon capture, parts of utilization, and storage, but our portfolio is broader. We work with direct air capture providers on proving methodologies, including the successful sequestration of the carbon dioxide. We're looking at the new hydrogen economy in terms of how we provide access to clean hydrogen quickly for dealing with both emissions that could be generated in the generation of blue hydrogen, as well as looking at underground hydrogen storage to prepare Australia, to be an exporter of ultimately clean and green hydrogen as part of the national hydrogen road map.

Matthias Raab: We're also looking at circular economy, carbon negative carbon neutral bio-refinery concepts to convert carbon to useful products. What we have done over the last 15 years in Australia is to demonstrate the storage of carbon dioxide. It is about 100,000

tons in various experiments, we're developing the technology that becomes available for industrial scale projects. It's fair to say that the technology development is about up to a decade ahead of industry deployment. We have developed domestically and internationally significant pieces of instrumentation and technologies that allow a very, very high degree of control of the carbon dioxide in the subsurface, which is quite relevant for commercial project operators in the context of carbon credits, and that's what we're here for today to discuss how the actual measurement and verification could be done appropriately to obtain carbon credits.

Matthias Raab: At the same time, we have developed the technology to understand the entirety of the operation also in context of injection licenses and environmental impacts, and to put a global view perspective up first to say, well, carbon capture and storage is an analogy and a valuable known commodity for over 10 years in conjunction with extractives in the oil and gas industry. We have globally, currently 26 projects in operation. We have about 13 commercial projects in advanced development. We're looking at about 21 projects in early development. Currently there is about 40 million tons of carbon dioxide that is currently sequestered per year globally, and looking at the extra global challenges, that puts Australia in the context, as well as the rest of the world where the industry is heading to, to achieve net zero and the target for carbon geological, carbon storage to be part of the 2050 net Zero mission, that is about 3.8 gigatons per year that is full, close to 4 billion, tons of carbon dioxide need to be sequestered for us to actually genuinely achieve net zero in combination with every other low emission technology that is available.

Matthias Raab: There's no exclusivity. There is a very strong need globally for all the technologies to really come up to speed quickly. From where we are right now to where we need to be, we need to look at probably a 100 times growth over the next 10 years, to meet our targets and to see how must get this industry well and fully established. The United States had taken a significant lead over the last few years looking at how the industry can be incentivised and the incentives were provided by a taxation system where 35 US dollars per ton can be credited for enhanced oil recovery. Up to $50 per ton of tax credits can be obtained by sequestering the CO2 in reservoirs without any other co-benefits. What we currently seeing in the Australian context, the incentives that are being put out by the Clean Energy Regulator are setting a significant signal with respect to making carbon credits available for sequestration projects in Australia, the current trading of carbon and the price likely to be associated with the credits. We have not heard this before.

Matthias Raab: My understanding is that it sits along the $20 mark per credit, but maybe Mel and her team can comment on this where it exactly sits, but it looks like the price point is about right to incentivise projects that are in the position to already separate the CO2 for natural gas processing, and then have a transport and storage component is the key factor of their costs to sequester the carbon dioxide. The signals are set in the right way and comments that were also made in terms of the methodology and the risk of reversal. Our assessment is that the methodology is mature. It is workable, and we as the industry have some suggestions for some, probably more immaterial changes for

practicality and simplification, but broadly we really welcomed the move that has been taken by the Clean Energy Regulator.

Matthias Raab: I would also like to make a point on the technology developments and the risk of reversal that was being put forward. We are working at CO2CRC on technologies and monitoring and measurement tools that have a resolution from on the surface of parts per billion. We are tracking as part of our research program, molecules with a discrete isotopic signatures and prices for the last 15 years, with an incredible resolution to fully understand the risk of reversal or what has mentioned before, should there be the migration of CO2 in the ground and up to the surface. We fully concur with the risk being extremely, extremely low. The international panel of climate change has deemed this to be unlikely to have 1% emitted back to the atmosphere over a 1000-year period.

Matthias Raab: So that shows the concept, it shows the significance, that geological storage is permanent, it is immediate. When we try to put this in the context of abatement and climate impact, the CO2 is taken away the moment it gets deeply into the reservoir. We are talking about reservoir depth of below 800 meters and likely several kilometers. It is very, very deep. From a permitting perspective, a sequestration project has to go through many hurdles in order to ensure that it is compliant with environmental impacts, that there are no environmental impacts and obtaining an injection license is even more stringent.

Matthias Raab: My final comment, just to look at very briefly what is happening in Australia, Australia had been leading the research development deployment and innovation in CCS, Australia is globally recognized for its position on the initial part on the demonstration, the safety and the implementation pathway. Australia sits also very firmly now on the world map by not only hosting the world's largest CCS project in Western Australia, but also with the opportunities that are in south east Victoria, Southeast Australia, and with other potential developments in central Australia, with the Moomba project as well as with potential developments on the Northwest shelf. The reason for that is that Australia has vast offshore resources, and space available to take essentially billions of tons of carbon dioxide for CCS.

Matthias Raab: Finally, of course we are not being able to store all of Australia's emissions, but CCS has the opportunity to have a significant environment aspect in Australia, which could be larger than what is earmarked globally of the 10% component could be significantly larger. On that note I'd like to hand back to you, John. Hopefully I've given a bit of an overview in terms of where Australia stands, where it sits globally, and also where the technology development gets high degree of confidence, in an industry going forward.

John Connor: Next up, Mark McCallum CEO of Low Emission Technology Australia, I'll hand over to you.

Mark McCallum: Thanks, John, and thanks for the opportunity today. So Low Emission Technology Australia is a $550 million voluntary fund. We've been studying and researching low emission technologies for over 10 years now, in particular CCS. Alongside Government

and industry, we've invested more than $250 million to help progress the understanding of the technology. That will be critical to reducing and removing emissions in those hard to abate sectors, such as steel, power, cement, and other industries. From that investment to date, we've been the first to capture CO2 from a power station in Queensland, we've supported the identification of large-scale storage potential in WA, in Victoria and now in Queensland. We've also supported the great work of Matthias and the team at the CO2CRC in the monitoring and the modeling techniques that can give communities and governments the confidence that CO2 storage is safe and it's permanent as well.

Mark McCallum: We've done a lot of research and now for us, we're in deployment phase. We're about to invest in deployment of our learnings. Our next phase is working with governments and industry to invest in the establishment of what could be a billion tons of CO2 storage in a hub up in Queensland, to the west of Toowoomba there, and construction, if it's approved, will start at the end of this year, with CO2 going into the Earth's crust permanently and safely stored there by the end of 2023. So not too far away, two years from now, we could see CO2 permanently stored and captured in a new Queensland hub. For us storage really then unlocks the ability to abate the industrial emissions from those hard to abate sectors that I mentioned before, the steel, power cement manufacturing, the industries, we rely on every day and use every day.

Mark McCallum: We're also investing in new technologies. We can unlock say green clean fuels or clean fuels from ammonia or from hydrogen, because we have an ability to store the CO2. The CO2 storage gives us an opportunity to invest in new technologies, new ways of generating energy. One of those we're investing in is with the US Department of Energy, the Allam Cycle. Instead of having CO2 as a waste stream, it utilizes the CO2 to generate energy. With storage, this is a fantastic technology that is then potentially unlocked for Australia. We're seeing increased momentum globally, as Matthias has mentioned. And obviously the importance of CCS is something we've recognized for quite some time. We're engaging with industry and governments to try and grow the partnerships that we have, to strengthen the investments that we have and bring those investments and that knowledge and that technology to Australia.

Mark McCallum: So that brings us to the ERF and the methodology for CCS. It's an excellent opportunity to bring forward those CCS technologies and complement the work that we're already doing in this area. We've been particularly pleased with the way the methodology has been developed collaboratively across industry, stakeholders, governments, and existing regulatory requirements also recognized, in the respective jurisdictions in which CCS will take place. We're also particularly pleased about the hub and spoke model. This is an important element of any Queensland hub that gets developed, but it's also what we're seeing around the world, where you're seeing North Sea hubs, you're seeing hubs develop around the world, where once the infrastructure is established, once the monitoring is all there and in place and you have confidence about the storage location, then other industries and other sectors then come in with little additional risk, not needing to go and re-establish an understanding of exploration, all those sorts of things that are required to establish large scale storage locations.

Mark McCallum: We're obviously working through some of the issues that Matthias mentioned, the issue of the reversal buffer and things like that. We're testing that work internally, both with the CO2CRC, but also the CCS Knowledge Center in Saskatchewan, the IEA and a whole suite of others that have looked at the issue of permanence for CCS for quite some time. CCS really opens up possibilities for cleaning the emissions of existing industries, but also gives us an ability to create new industries, invent or bring to Australia new technology. We're really excited about the future of CCS and the ERF and the model that's being developed at the moment will play a critical role in bringing that work forward.

John Connor: Mel, the question around the risk of reversal buffer, perhaps do you want to talk about how you got to the 3%. Is there a risk reversal buffer in emission avoidance methods, for example.

Mel Ford: Thanks, John. I think Megan did explain why we landed on the 3%, but I thought it was worth highlighting that there's two aspects of the risk reversal management approach that we've taken under the method. Within the crediting period, any reversals that might appear are obviously taken into account in the net abatement calculations. If there's any leakage into the atmosphere, then that is taken off the net abatement calculation. The 3% risk of reversal buffer, we felt was an appropriate level to manage the risk. There's lots of evidence to suggest that the risk of reversal is much lower than 3%. What we were trying to do there was balance the different perspectives we've heard from stakeholders, and the Emissions Reduction Assurance Committee will have views on the risk of reversal as well.

John Connor: Are the existing projects, such as Gorgon, having access to this? Are they able to have access to this method?

Mel Ford: I don't want to comment on any individual circumstances, but the CFI Act does have an exclusion mechanism for projects that are required to undertake activities in response to a regulatory obligation. That's an important component to be aware of as you said, John, there's also the newness requirement, under the Emissions Reduction Fund, in order to be registered, the project needs to be new. That is that a final investment decision hasn't been taken.

John Connor: Can you perhaps expand on what will make legislative change for the direct air capture example discussed earlier.

Mel Ford: There's probably two barriers to the inclusion of DAC at the moment. The first is that the CFI Act doesn't recognise DAC as an eligible technology. There would need to be a change to the CFI Act. The second component is in terms of that environment, being able to contribute to Australia's national international emissions reductions targets at the moment, there isn't those international standards that can be followed in order to have DAC contribute to the inventory and into our international emissions reduction targets.

John Connor: Have you looked at the alignment between this and overseas evaluation and reporting? This is with its greenhouse gas protocol standards.

Mel Ford: In developing the method, we were cognizant of some of the existing standards that exist around carbon capture and storage. There are specific requirements that a ERF method needs to meet. We have developed a method that we feel is fit for purpose, under the Australian circumstances, and that meets the requirements under the CFI Act. We're interested in people's views on that and welcome submissions.

John Connor: Just a recap on that risk of reversal, what's the international data that CRCCO2 is saying is there in terms of the projects that have been operating and leakage to date, Matthias?

Matthias Raab: No project, to my knowledge, has registered any leakage. The whole intention is to have access to deep reservoirs that provide pretty much close to 100% storage certainty. The regulations that are put out in the world, the United States is leading under the EPA Class 6 regulation which is very, very stringent, have the purpose of protecting underground drinking water resources. That, together with the international standards that are being developed, really declare the level of certainty that a project has to have before it even can go ahead. We are talking about an expectation of pretty much no leakage and the first of a kind project, the Shell Quest project in Canada had actually made statements that if they recorded any leakage, they will not continue with the project.

Matthias Raab: These are very bold statements by the industry that gives the confidence in the subsurface operations. And if we matched that with technologies that are being developed, we do understand that we have a very good handling. All of that together I believe we are in a territory where the risk of reversal is a mechanism at the 3%, as Mel has now assigned to balance different stakeholders being involved. But technically the actual risk that we're taking from an operational perspective is far lower than that, orders of magnitude lower.

John Connor: We've seen the reports about Gorgon not meeting some of its own targets. To what extent does this undermine the confidence in this CCS method?

Matthias Raab: I would say obviously I can't talk on behalf of Gorgon, I'm taking the information that's out in the public. What is to be recognized as that Chevron has probably delivered one of the largest infrastructure projects ever done on the planet so far. The project has encountered delays, but it had not encountered any obstacles that is preventing Chevron, to in the long-term I believe, achieve the injection targets. What we know from a technical perspective is that the actual confidence in the reservoir storage is actually higher than probably initially estimated. If you take the project delays aside, which led to not having met the initial emission targets, and look at the confidence in the methodology actually working, I think we need to see the positive side, that the methodology is working at a scale, that had not been demonstrated before. So that's a great steppingstone for the next generation of projects coming.

John Connor: Mark can we look at the economics here, particularly around that $20 price, what sort of technologies are likely to be first cab off the rank and how will this affect other things?

Mark McCallum: I think there's a few elements to view around the cost of storage, the cost of transport, the cost of compression and the cost of capture. There's a whole range of elements that come to CCS and how much it costs for each project to capture, transport and store CO2. I think if you are looking at which technologies will be the first ones to be the first cabs off the rank, it will be those where the cost of capture is more affordable. So those emissions where there is 99% pure CO2 already. Say you're stripping out the CO2 as part of the production process for natural gas or something like that, their concentrations are generally 99% CO2 or thereabouts. For emissions that come off say steel or cement, or even power the concentration of CO2 is about 12-14%. If you want to capture those emissions, you have to concentrate them for a carbon capture process that puts them through amines and essentially strips out all the other elements and concentrates it down to 99% pure CO2 before you then get to transport and storage.

Mark McCallum: If you're looking at the Queensland model for the Queensland hub that we're looking at, it's under $5 a ton to store and monitor. For the cost of transport, the closer you are to that site, the more affordable it is obviously. The power stations or the industries in that area, they will obviously be benefiting from lower transport costs. I think you'll find that those industries that are able to concentrate their emissions — either through natural gas production on say ammonia or hydrogen, or those say coal gasification, those processes that actually concentrate down those emissions to 99% or more pure CO2 as part of their process in what they're making and creating, they will be the first.

Mark McCallum: But then once you've utilized that, and you've created the infrastructure and the network of pipelines and workforce, and those sorts of things, then the harder to capture CO2 industries can certainly reap the benefits of what's come before them. So I think that it's going to be a case of low-hanging fruit to target the higher hanging fruit, and the ERF obviously adds to that equation. I think that the ACCUs, the value of them today versus the value of them tomorrow, versus the value of them in 10, 15 years from now, I think we all have to start factoring that into account. Plus also the value that our customers might put on say, good green hydrogen, or clean hydrogen, what's that value and what's that premium that they'll be prepared to pay. Once you see those sorts of things coming through we really get a good sense of what the market looks like and what projects start to stack up in terms of Australia being able to provide clean energy to export customers, as well as to our own domestic industries as well.

John Connor: Thanks, Mark. And the potential on some of these sites in terms of storage, Moomba, what sort of potential is there, for example, what are we talking about in scale?

Mark McCallum: In terms of scale, for Moomba, I can't speak for Santos, but I do know publicly they've got a 1.7 million ton per annum project that they'd like to sanction and take FID on. That would be one of the larger projects. They'll utilize old oil fields or old gas reservoirs, and so have a very good understanding of how that CO2 will be contained. If you look up in

Queensland and the Queensland hub where we are, you've got around 21 million tons of emissions coming out from existing industries to the west of Toowoomba there, or within about a hundred to 150 kilometers from the existing hub. A billion tons of storage capacity, 20 million tons per annum. You've got a lot of excess storage capacity there. Industries from Toowoomba, from Brisbane, from Gladstone, from Mackay could all start tapping into an infrastructure network there in Queensland.

John Connor: At that sort of scale we are going to see the Emissions Reduction Fund gobbled up pretty quickly. Is there confidence enough that this is enough of a resource and where do we need to be going with some of our broader policies?

Mark McCallum: On the Australian side of the equation, the ERF is the ERF, and if you take the 20 million tons per annum at $20 a ton, that's $400 million. You can see that if we're at large scales then you'll eat into that $2 billion fund pretty quickly. But on the other side of the ledger, in terms of what I was mentioning before, our customer nations, Japan and Korea and Taiwan and others around the world, they'll be looking for these products that we can provide — green hydrogen, clean hydrogen and clean ammonia, all sorts of interesting new clean energy fuels that the world needs in order to get to net zero emissions. I think it's going to be a bit of both, but as you can see, if we're going through 20 million tons a year, at $20 a ton you can do the math as well as I can.

John Connor: I think the point you made earlier around market interest in that clean premium, is something that's certainly there, and interesting to see how that goes and how that falls on the clean green perspective. Matthias, any closing comments?

Matthias Raab: In addition to Mark's comments, I would say what's important is the commitment that we are focusing on low hanging fruits. Where we can demonstrate abatement at scale, that sits in combination with cleaning up existing emitting industries, as well as enabling future industries. We're talking about hydrogen in particular, if you build this big picture together, to enable a vast green hydrogen economy, we need to start with lowest cost hydrogen production to market, to really get this into place that does involve CCS at a scale which again sits well and totally within the opportunities within Australia. In that sense Australia is in an exceptional, good position to actually lead with both the technology and the emissions reduction at that scale globally.

John Connor: Thank you. Mel any closing comments or things that you want to respond to in the chat or questions that we haven't had a chance to look at yet?

Mel Ford: All I'd say is I think there's a lot of excitement on both the demand and the supply side in Australia's carbon market. We look forward to seeing how that evolves over time. In terms of the CCS method, looking forward to having a look at the submissions, please reach out if you'd like to talk to myself or Megan or Patrick, happy to talk through the method and receive feedback and look forward to receiving submissions. Thank you very much for the opportunity to talk to everyone today and thank you to Megan and Patrick.

John Connor: Thank you. This is really important, to understand some of the facts that are out there, make sure we have good scrutiny of this. What we're trying to ultimately see is the transition to net zero emissions, and negative emissions. Building up systems with integrity and assurance is really critical as we're going to need to carry a fairly skeptical community along with us on the way. I thank everyone who's participated and thrown your views out there and hope that they've been shared. Thank you everyone.