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In conversation with Professor Tim Flannery

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*The inaugural Mick Dark Talk for the Future was given in 2015 by Professor Tim Flannery (Climate Council), one of Australia's preeminent writers on climate change. The event was hosted by Varuna Writers' House in partnership with the Blue Mountains Conservation Society and took place at the Wentworth Falls School of Arts. The Mick Dark Talk for the Future was founded after Mick Dark's passing, to honour his legacy in environmental activism and his generosity in bequeathing the Dark family home to the NSW Government for use as a national writers' centre. After his talk, Professor Flannery spoke about his new book *Atmosphere of Hope* (2015) with author and academic Dr Kate Fagan. The following is a transcript of their conversation. The complete audio version of Professor Flannery's talk and the Q&A session following was broadcast on ABC Radio National's "Big Ideas" program in October 2015.*

KF: Tim, two words you mentioned in your talk just then were 'scale' and 'imagination'. They seem like touchstones for the book. A lot in the book is working at a gigatonne scale – an absolutely enormous scale that seems beyond our imagination. So I wanted to ask about scale, and about how capable we are of thinking in the non-human, or the beyond human.

TF: Well that's a great question, and it is something I didn't really have a chance to cover. Last year we emitted about forty gigatonnes of carbon dioxide into the atmosphere. That's a number that I struggle with. So I thought: how do I, how do we, comprehend what a gigatonne of carbon is? I thought, perhaps the best way of approaching this is to say: what would it take to draw four gigatonnes of carbon dioxide *out* of the atmosphere? We're putting in forty, and we're talking about taking back four, using some "third way" technology.

One obvious way that we all understand inherently is tree planting. How big an area would we need to plant with forest in order to take out four gigatonnes? It turns out you need to plant an area the size of Australia, over a 50-year period, taking a New York State-sized hunk every year for 50 years and planting it, and keeping the trees growing and growing vigorously over that 50-year period. At the end of that you would have taken out, on average per year, about four gigatonnes of carbon dioxide. But of course, if you did that, you would also warm planet Earth because Australia is a very bright surface. It's got lots of desert and salt lakes and grasslands that reflect sunlight back into space, and therefore that sunlight doesn't warm the Earth. If you replace that with a dark forest canopy the sunlight will be absorbed, turn into heat energy and warm the planet, despite the fact you took carbon dioxide out of the atmosphere.

So, for me, a gigatonne of carbon dioxide – the best way I can think of explaining it – it's a volume of carbon dioxide or greenhouse gas which is of consequence at the scale of planetary function. Forty gigatonnes is way, way too much. It really is a volume which is threatening planetary function.

KF: Can I ask a little about what you describe in the book as the "carbon bubble"? Because this was a moment of hope for me in the book – when I realised what you were saying about decoupling global economies from a carbon based, fossil fuel based economy. I gather the carbon bubble is to do with unusable asset bases in carbon. Can you say a little more about that?

TF: Sure. This concept of a carbon bubble comes from the work of scientists who have framed a carbon budget for planet earth. Unfortunately, most of the political discussions around climate change are framed in terms of degrees Celsius. The major world nations have agreed not to let temperatures exceed two degrees Celsius. But without a carbon budget to constrain the volume of carbon dioxide that will take you beyond that point, it's a pretty meaningless statement. So, scientists have been at work saying, how many more gigatonnes of carbon can we put up in the atmosphere, if we are to stay within two degrees?

It turns out that to give us a 75% chance of staying within two degrees, the carbon budget is around about 650 gigatonnes. Now we'll be right through that carbon budget by 2028 if we keep going as we're going. And really, that will be it. We'll be committed. But if you look at that figure and compare that with the valued fossil fuel assets that companies like Exxon,

Mobil and others have stated, in terms of their value reserves on the stock market, you see that fossil fuel reserves dwarf that. In fact, if *all* the fossil fuel reserves that are valued on the stock market were burned, we would create 3000 gigatonnes of carbon dioxide.

So, we've got the carbon budget, and we've got the political limit of two degrees – and both are wildly out of sync with the valued assets of fossil fuel companies. Unfortunately, the way stock markets work is that, if things change, they change very quickly. I think the Governor of the Bank of England recently said this is a real threat – that this asset bubble could have real global consequences, if all of a sudden it is clear these are assets which can never be used. Because these companies will then face massive devaluation and losses.

KF: There's a terrific example in your book about Kodak inventing or developing digital technology that does itself out of business. It's a moment I loved, metaphorically as well as actually in the book – because of the idea that carbon asset based companies have to devolve, in a radical way, to be replaced by the disruptive technologies you're speaking about.

TF: The history of change in this area is that really the giants don't tend to adapt. They tend to die off and a new generation of small companies comes up. And you can see it happening. For most of my adult life, Exxon Mobil was the largest company in the world, or the most valuable company in the world. That's changed now. A whole lot of digital companies have come up and displaced it. And I think they will die. I think the world of 2050 is again going to be unimaginable because the fossil fuel companies won't exist, or at least as they are at the moment. I don't think many of them will adapt. You'd hope that they would be able to, but BP tried the experiment under Lord Brown. They tried to grow their clean tech, their solar section. But it proved too challenging.

KF: Let's talk a little about social media, and perhaps its corollary, which I sometimes think of as anti-social media – and the role that some of our large media conglomerates have in putting messages out there about climate change. How concerned are you about that, and how real is the capacity of social media to counter some of that messaging?

TF: Well again, I think in my lifetime, things have changed so dramatically. I mean in the last 15 years, and in my adulthood. I remember buying the newspaper when it was a big broadsheet. That was what you did. You sat on the train going in to work reading the newspaper and that's how you got your daily information. That age looks archaic now. When I see people reading *The Australian* broadsheet, it just looks antique. Ten years ago, it was just the way things were. Digital media is now where people get their news and that's a much more democratic way of doing it, and much more difficult to control. Under the old system with print media I think it was much easier for the newsfeed to be controlled, and for people not to see all of the alternatives. But we're moving into a much more dynamic future that will, I think – again it's going to be part of that decoupling process – we're seeing this world in change. And I do wonder if we'll look back at 2015 as the fulcrum year when things started to change.

KF: There's a point in your book where you talk about fifteen countries in the world being responsible for 70% of emissions. How do we reconcile what developing countries are being asked to do, against what developed countries *must* do?

TF: Look, I think that's a very, very fundamental question. I do some work with Tartar power in India on their sustainability advisory group. They're the largest energy provider in India, so I get to see it a bit close up there. And they've got a lot of really old and very polluting coal fired power plants in India, but they can't generate enough electricity as it is. Whenever I bring up issues around this with them they say: well, why aren't you closing down your old coal fired power plants? You've got older ones than us even, in the La Trobe Valley. They're more polluting and less efficient than our plants in India. So why aren't you, as a very wealthy country, able to close those down?

And the thing is, as I mentioned in my talk, we do have mechanisms. The Clean Air Legislation has been under discussion for years. Federal Clean Air Legislation would be a perfect mechanism to do that. We could do it if we had the political will to do it. It would be an easy thing to do, because those power plants are towards the end of their lives anyway. And it would send a great signal to places like India that we need to move on this.

That's one side of the story. The other side is employment and renewables. I think that places like India, and certainly Africa, are going to leapfrog over this era of gigantic power plants with a kind of "spoke and wheel" distribution of electricity. They will have community based grids with a lot of local generation. It will be solar and wind and biomass and whatever resources are available locally – sustainable resources. But those are still expensive options as of 2015. They may not be in 2020, but we need a long term strategic view of this, otherwise you'd lose hope pretty quickly.

KF: Do you anticipate the cost of renewables to keep moving downward at the rate that it is?

TF: They absolutely will. I mean, again I do a bit of work with Semens, I was with their Sustainability Advisory Board for ten years. They're a giant engineering company and wind was one of their big things. They're in the process now of utterly transforming the way that wind turbines are made. They started with gearless wind turbines, which are these turbines where there are no gears inside. It's hundreds of less moving parts and there's far less maintenance. They're now moving to a system where they're going to containerise everything, so if you buy a wind turbine it will come in shipping containers. Every bit of it – so it will cut down on costs of transport enormously. And once the wind turbine is in place, the blades run out. They gradually wear away, just like the blades of a propeller wear out. What they're doing is putting 3D printers on the blade. Now they just run up and down and keep that blade operating just perfectly. So, they never need to replace the blade. With all of these things happening it looks like the costs are going to halve. Costs of electricity from wind are going to halve in the next five years. And solar is the same. These costs are just going to keep coming down.

KF: And the storage issue... I mean, what's going to happen in terms of photovoltaic capacity to store from wind and solar? They seem so important to our future.

TF: They do and they are. And could I just sound a slight note of caution here because there's been a lot of hype, I think, around batteries. They've got a huge potential, there's no doubt about it. But we have to remember that the company everyone thinks of when they think about batteries is Tesla. Tesla made 35,000 cars last year. That was all. They were

aiming for 50,000 and they only made 35. The biggest electric car manufacturer in China, BYD, made 2000 cars last year, mostly hybrids. They hope to make 20,000 this year and 200,000 the year after. But we're starting at a little scale. And when you think that China is adding 15 million new vehicles to the road every year, we see how far we've got to go with battery technology. Now let's hope it develops as quickly as wind and solar, or even faster. And it will be hugely important and transformative as it comes of age. But we have to understand that we're starting from a very, very small base.

KF: Before we broaden out the conversation, I wonder if I can ask a little about the run up to Paris that you mentioned, and the kind significance of the US-China announcement at the end of last year, in terms of your hopes for the outcome of Paris. What do you think Australia's ongoing role in those negotiations might be?

TF: Well, President Obama has been so central to all of this because he was the one who plucked something out of the Copenhagen catastrophe. And that something was the Copenhagen Accord that started this bottom up approach to dealing with climate change. That's now the basis of the new Paris Agreement. We've had some quite ambitious pledges made under that Accord for reducing European emissions at least 40% by 2030, which is great. We're still not there. We're still aiming at three degrees roughly, rather than two degrees where we need to be. I think we can already see that Paris will be a success because so many pledges are already there on the table.

One of the things I hope is that we can shorten the review period for countries' commitments from ten years to five years, because the technology is changing so quickly that ten years is just too long. And if we can change it to five years then maybe we can tighten that trajectory a little bit every year. But through all of that I think we need to think about those "third way technologies". Before I wrote the book, they didn't even have a name. They're not on the political radar, and people aren't thinking imaginatively about the role they could play in our future. We need to clamp down on those emissions and Paris will be part of that. But we also need to start investing in these other options at 10, 20, 30 years [from now]. Sometime they will be a big part of it.

KF: And the way you set that up in the book is that there's been a failure of recognition, in a political sense, that they are separate situations – that *emissions* are one thing, but the *removal* of carbon is another thing altogether.

TF: That's right. The Australian government at the moment, through direct action programs, claims it's reducing emissions, which is rubbish. Emissions are growing. Emissions from the burning of fossil fuel are growing. But they are doing a good job in terms of direct action, in terms of helping to do some research and development, and fostering early stage development of third way technologies on-farm. And that's important. But it's not emissions reductions. We need to have in our mind, absolutely clear, that they're two separate things. We can frame policy then to do both very well.

KF [to audience]: I urge you to have a look at the book, and have a look at how quickly the technological field is moving. There are things Tim is literally popping into the book as it goes to press, about what is being developed.

TF: The latest one was coffee grounds! Can I just please...

KF: ... yes please do.

TF: Such a strange one. Just a week ago South Korean scientists announced they'd found a way to activate used coffee grounds to capture atmospheric methane. Unbelievable. Methane is sixty times more potent as a greenhouse gas than carbon dioxide. Now again, I don't know what the volume of used coffee grounds is generated, but I suspect we'd all have to be drinking 10 cups a day to make a dent in the problem. But still the fact that this has actually been announced, and people are thinking about these options, is enormously energising for me. It's fantastic.

KF: And look, there's such a question of time. Because as you said earlier, the time to let these things take their course and be tested, and implemented at scale, is such a big issue. I wanted to draw attention to one image. As someone who works mostly in the field of literature, one thing that excites me about Tim's book is that it's very much about the meeting of science and the imagination. It's about how, in a way, imagination can be a sort of "social warming" effect of innovative technology. That's very exciting for me.

There's an image at the end of the book of a proposal for hundred-metre cubic refrigerators in Antarctica absorbing carbon dioxide into cooling snow. And it is science-fictional, it really is. But Tim makes the point that a lot of the technologies that are now standard lounge-room, household technologies were of that order 40 or 50 years ago. And we need the courage to imagine that some of them might just work. I think it's a wonderful image.

TF: It is a strange one. I came across this idea from some astrophysicists who looked up at Mars and said, well that planet has got ice caps made of frozen carbon dioxide. Why don't we have it on Earth? It turns out that it just doesn't get quite cold enough over Antarctica. It's about average temperature of -57, whereas carbon dioxide will fall out of the atmosphere as frozen snowflakes at -78.5. It gets to -90 in Antarctica occasionally so it does snow carbon dioxide on occasion. But unless you bury it, it just sublimates and gets back into the air.

So, they said: why don't we think about these great big cubic freezer boxes we could put up to drop the temperature a few tens of degrees, and let it snow carbon dioxide? How much energy will we need for it? They said to get a gigatonne of carbon dioxide out a year, we'd need about half the installed wind energy of Germany. Which is not much. I mean the continent is huge, you know, and we know wind turbines work in Antarctica. A lot of the research stations already have them. You'd have these great big cubes, dig a bit of a hole under them, put the carbon dioxide snow in, cover it with real ice or snow, and there it is – there's your storage.

When I thought about it, my first reaction was: but the Antarctica is the world's last wilderness! Do we really want to be doing this to it? And I thought, actually we need to investigate the proposal. Because in 20 years' time, as the Barrier Reef is dying, as all of these other things are happening, do we really want to rob our children of one opportunity to do this? My initial response smacked too much of nimbyism to make me comfortable, but that was right. I think, as sci-fi as it sounds, and as many objections as we might have about it, we need to investigate it because if we don't we'll rob our children of hope.

Audience question: Tim, you talked about geo-engineering and how it's not an effective long-term solution – but if necessary it could be used as a transition policy to buy us a little bit more time, while we implement those sustainable long-term solutions.

TF: Look, I guess if we fail to reduce emissions and there are catastrophic outcomes – like very, very rapid sea level rise, which is very possible – I guess under those extreme circumstances, you might want to invoke geo-engineering to do it. But you'd want to do it with a global consensus because the consequences are going to be very severe for a lot of people around the world. And if you stop that geo-engineering process part way through, you'll get a very strong rebound of the heating effect, which can be destabilising in its own right. So, at the moment, in the book I say we shouldn't be pursuing these proposals. There's no global treaty around how we deal with it, or no global agreement as to how we deal with it. And we still have time to avoid the worst consequences, if we stamp down on emissions and develop third way technologies to get the carbon dioxide out of the air at scale in the next 20 to 30 years. At the moment, and it is a subjective view of mine, I just feel the risks are far too great in pursuing geo-engineering technologies for the moment.

Audience question: Thanks Tim. You've talked a lot about carbon today, but what about methane?

TF: Well, methane is responsible for about 20% of the warming potential that we've seen already in terms of the atmosphere. The trouble with discussing methane in any detail is it's a much more poorly understood process. The ethane cycle is much more poorly understood than the carbon cycle. I try to document this in the book – the extent to which people are not certain how much of the current methane going into the atmosphere comes from human sources, and how much from natural sources.

The methane curve has been doing some very strange things recently. You know what I mean? In 2005 and 2006 the amount of methane going into the atmosphere started to really decline. By about 2007 it started to go backwards so there was less methane in the atmosphere, less concentration than the year before. Then it started to grow again. It's been growing at about the same rate as carbon dioxide concentrations have been growing. But there is such a lack of understanding around where that methane is coming from. It's still an area under active research. I think it's a really important area and I think we need to pursue it, but to try to understand the methane cycle in the same detail we understand carbon is still beyond our grasp.

Audience question: I agree with you – we may well be at a time where we do need to rethink our political paradigms. And I'm just interested in what you can see, either with our current paradigm or other alternate paradigms, in terms of achieving binding mechanisms for international efforts on environmental issues.

TF: Yeah, that's a really good question. I was involved in the Copenhagen meeting pretty deeply. I chaired the Copenhagen Climate Council for three years, and tried to assist the Danish Government and business to come to a treaty agreement. And that failed spectacularly, that meeting. I was really in the middle of it. And with Paris, we're not going to have a treaty. That's for sure. Now is that a good or a bad thing? Lord Sterner has argued it's probably a good thing, because he said people become more ambitious when they set their own targets. You allow them to set their own targets, rather than impose a target from above, through a sort of treaty mechanism. I guess there is some virtue in that.

People say it isn't legally binding and treaties are legally binding. But getting action on people who breach treaties is really hard. Canada is a good example of that: under the Kyoto Treaty, Canada grossly exceeded its targets. But Ban-Ki Moon never sent the blue berets in, or blue helmets in, to try to get them to wind back on the tar sands developments. So, I guess I'm cautiously optimistic that Obama's approach. This bottom up approach is going to deliver us some substantial gains. It may prove to be not enough, but in the current political environment it's really hard to imagine getting a treaty in place. The US Congress would have to ratify it by 70 votes out of the 100 for example, which is very difficult to imagine. And then how do we develop teeth – a treaty with teeth – where people will act on it? I think these are difficult questions and we are kind of muddling through them at the moment.

I talked to Al Gore about this recently. I said: how would you characterise the current ambition, the current mechanisms sorry, in terms of Paris? Is it like the gold standard? And he said: no, it's the Bitcoin standard. And it's probably true. But that's the reality of where we are.

KF: I think cautious optimism is a lovely place to finish. I think all of us wish we didn't have to. But please join me again in thanking Tim Flannery for his time and his thoughts.

TF: Thank you.

About the conversationalists

Professor Tim Flannery is one of Australia's leading writers on climate change. An internationally acclaimed scientist, explorer and conservationist, Professor Flannery was named Australian of the Year in 2007.

Professor Flannery has held various academic positions including Professor at the University of Adelaide, director of the South Australian Museum in Adelaide, Principal Research Scientist at the Australian Museum, and Visiting Chair in Australian Studies at Harvard University in the Department of Organismic and Evolutionary Biology.

A well-known presenter on ABC Radio, NPR and the BBC for more than a decade, he has also written and presented several series on the Documentary Channel including *The Future Eaters* (1998), *Wild Australasia* (2003), *Islands in the Sky* (1992) and *Bushfire* (1997). His previous books include *Here on Earth* (2010) and *The Weather Makers* (2005).

<https://www.climatecouncil.org.au/contributors/tim-flannery>

Dr Kate Fagan is a prominent Australian innovative poet whose third book *First Light* (Giramondo) was short-listed for both the NSW Premier's Literary Awards and the Age Book of the Year Award. She is the convener of the English Major within the School of Humanities and Communication Arts at Western Sydney University and a former Editor of *How2*, the