Melbourne – Climate Change: What happens after the Paris Conference?

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The Australian Government's emissions reduction target will join those of the international community in Paris in December. It is likely that the sum total of these contributions will not be consistent with the internationally agreed objective of keeping the average global temperature increase to less than two degrees Celsius. How will this play out in Paris and what does the target imply for the energy sector? Tom Arup from *The Age* discussed this issue with David Karoly, Professor of Atmospheric Science at the University of Melbourne and Member of the Climate Change Authority, Anthea Harris, previously CEO of the Authority and now occupying a senior role in the Victorian Government and Tony Wood from Grattan Institute at this Energy Futures/Policy Pitch event.

Speakers: Tony Wood, Grattan Institute
Tom Arup, The Age
David Karoly, University of Melbourne
Anthea Harris, Victorian Government

TOM ARUP: Australia's gone through a quite remarkable decade in climate policy, I've been covering it since about 2008 and in that time there has been five Prime Ministers, all of whom have risen and fallen to some degree on climate policy. At the same time, we've made commitments to the global community about our emissions and how much we will reduce them. We initially pledged to reduce our emissions by 5% on 2000 levels by the end of this decade and, depending on who you listen to, we're either on track or not on track to meet that target. Just recently we also committed to reducing our emissions by 26% to 28% from 2005 levels – note the difference in the baseline. That sounds very familiar to the US target, but the US are committing to do that by 2025 and we're committing to do that by 2030.

The question is going to be two-fold. First, how will we achieve that target? Climate Action Tracker, which is a group of four independent and very well-credentialed consultants and think tanks who have been doing assessments of major countries' commitments, recently said Australia was the furthest behind of all the developed countries to have policies in place to meet their 2030 goal. The gap between what we've currently got legislated and what they think it can achieve and what we need to achieve in terms of total emissions cuts by 2030 is greater than the US, Canada, New Zealand and a range of other like-minded and similar countries. In about seven weeks the world's countries will meet in Paris and we expect or there's a strong chance some kind of lasting agreement will be signed on climate change. Thinking back to Copenhagen, this seems like a small miracle. I personally wasn't there, I was reporting on issues, but a lot of people who were there all have a war story, they've all got a bit of trauma about it. I don't think the poor city of Copenhagen has ever recovered.

Paris will likely deliver an agreement that will be built on over many decades. Its ultimate aim is to restrain global warming to less than two degrees from preindustrial levels. There are 149 pledges now under that process from countries to reduce their emissions out to 2030. A number of people have done assessments of that and those assessments suggest that we're still wide of that two degree mark. Overnight the European Commission put out its assessment and said if the targets were committed to it would take us on a pathway to three degrees. What does that mean? Well, it likely

means we'll have to revise our targets, all the world will have to revise its targets in the coming years. And that's where Australia and the policy puzzle comes in because not only do we seemingly have a gap between the target we've pledged, we've also potentially got a larger gap when we start thinking about the actual kinds of cuts we might need to make to meet the global commitment to restrain global warming to two degrees. So what should we do? We've got three experts on the stage much smarter than me, been around much longer than me, who are going to talk you through some of the options.

First up will be Professor David Karoly, he's a Climate Scientist at Melbourne University. He's been involved to differing degrees on the last two IPCC (Intergovernmental Panel on Climate Change) assessments of climate science and he's also a board member of the Climate Change Authority, one of the original board members and continues to serve. Anthea Harris will be next. Now I had to write down the name of the department Anthea because all Victorian departments have very, very long names. You're the Lead Deputy Secretary for the Department of Economic Development, Jobs, transport & Resources, but don't let that title fool you. Anthea's been involved in climate policy for well over a decade, she was involved in the development of the GGAS scheme in new South Wales, Australia's first mandatory carbon trading scheme, and she's been involved at both the state and national level in the development of other carbon pricing schemes and, most recently, was the Chief Executive of the Climate Change Authority, until she moved back to the Victorian department. Last but not least is Tony Wood. He's the Energy Policy Director of the Grattan Institute. He's got a long history in energy policy, working for Origin for many years before that, and he's also worked for the Clinton Foundation on a range of low carbon technologies for a number of years.

I'd like to welcome first up David Karoly.

DAVID KAROLY: Thanks Tom and it's a pleasure to be here. I've been asked to give a sort of global perspective from the climate as well as the greenhouse gas emissions on what's coming up to the Paris conference.

I'm not going to really speak about the solutions and what's going to happen beyond Paris very much, but really what the challenge is in terms of meeting this global commitment of limiting greenhouse gas emissions so that global temperature rise is less than two degrees. But to set that in context, we should look first at what's happening to temperatures. Depending upon which newspaper you read or which blog site you look at, global warming stopped in 1998 and there's been no warming since then or it's been cooling. But if you actually look at the global temperatures, this is a record from the National Oceanic & Atmospheric Administration in the United States and it shows the average temperatures each year from 1990 right up until the first eight months of this year for January to August, and you can actually see that if you could get a bet on, no bookmarker's actually taking this bet anymore, that 2015 will be the hottest year on record in the instrumental data. It already is by a significant margin and that doesn't include September, we already know that's hot, and it's going to get hotter because we're also in an El Nino event.

So yes, global warming has continued, there is a lot of natural variability, but the rate of warming has been substantial of the order of eight-tenths of a degree Celsius or a little bit more over the last hundred years. But what we can expect in the future depends on what happens in terms of greenhouse gas concentrations. It also depends on a lot of natural variability and uncertainties in the climate system. But when we look at this graph, which comes from the most recent IPCC

assessment, this left-hand part shows the observed temperature variations over the 50 years from 1950 up to the year 2000 and then we look into the future and there are two different scenarios. This upper one in red is the sort of business as usual emissions, what we would expect if we continue to burn fossil fuels and to grow emissions, as has happened over the last 50 and 100 years. And what we see is that the best estimate is four degrees of temperature rise relative to present day, possibly as much as nearly six degrees relative to present day added onto the eight-tenths of a degree we've had already. The alternative is this scenario, rapid emission reductions which stabilise temperatures at only about one degree above the year 2000 levels, about one-and-a-half to two degrees or so above preindustrial. The really interesting point is what is shown here is the uncertainty range. There is a large uncertainty associated with the uncertainties in the processes in the climate system. We have to think about what risk we want to take in global temperatures staying below two degrees or what risk we want to take in warming above two degrees. That will be determined by what happens in terms of future emissions.

So now let's look at the different emission scenarios associated with those different emissions and those different temperature ranges, and here we are with business as usual, current emissions are around 45 billion tons of carbon dioxide and other greenhouse gases. In this case we end up with warming in this baseline scenario and carbon dioxide concentrations in the atmosphere much greater than a 1000ppm (parts per million). We are already at 400ppm and that's already 40% higher than we had in preindustrial times. The alternative to achieve warming of less than two degrees is this scenario here. Notice that greenhouse gas emissions go to zero before the end of this century. So what Paris is about is setting the trajectories for all countries to contribute in a fair and equitable way to meeting these global targets of reducing greenhouse gas emissions so that they essentially decarbonise the global economy this century. And, in fact, if we look at what's happened here and we're now at 2015 - this graph actually starts in 2010 - we actually have to be dropping emissions pretty well straight away.

So then we can look at what each country has committed to, and I'm not going to look at all 140 countries that have made commitments in their indicative nationally determined contributions leading into the Paris conference, I'm just going to look at a number including Australia. This is in fact a comparison that was put out by the Climate Change Authority in their report when they had a recommendation to the government on what Australia's emission reductions should be. Each country leading into Paris has indicated in a bottom-up process what they want to do as their fair and equitable contribution to reducing greenhouse gas emissions. These are called INDCs (Intended Nationally Determine Contributions) to global emission reductions. The Climate Change Authority recommended that Australia's emission reductions should be 30% below 2000 levels by 2030 and 40-60% below 2000 levels by 2030. The Australian Government listened to that advice, didn't take much account of it, and then agreed to or has put into the Australian INDC emission reductions of 26-28% below 2005 levels by 2030. Tom's already mentioned that and the important thing to understand is that Australian emissions grew by 5% from 2000 to 2005. So to put different countries' emission reduction targets or even the Australian emission reduction targets to a common baseline the Australian Government's target, 26-28% below 2005 levels, is only 20-22% below 2000 levels.

So now we can do some comparison and the comparisons between different countries' targets depend upon what metrics you use. So I'm going to look at a couple of different metrics and the first one is just the absolute percentage reduction in emissions. And if we look at this, Australia sits in roughly the middle of the pack. In terms of the Climate Change Authority's recommendation, this

shows changes from 2005 baseline to 2025, so relative to that period the Climate Change Authority's recommendation is actually 36%. The Australian Government's would be 26% and that would sit back here, right in the middle of the pack, and that was why the Australian Government said a 26-28% reduction was in the middle of the pack. What about if you use another metric like per capita emissions? This shows Australia's per capita emissions of greenhouse gases. And if you were going to carve up pizza and distribute it to everyone in the room or carve up chocolate cake and give it to everyone in the room, everyone would think that actually it's probably fair that everyone gets the same amount. But, of course, the alternative would be to say well actually, the people in the front should have more because they're closer and they can eat it and get to it faster.

Now maybe Australia and the United States are like the people in the front row who could get to the greenhouse gas emissions through burning coal and oil and natural gas faster and that's why their per capita emissions are higher than some of these other countries, because Australia hasn't reduced its emissions over the last ten years. In fact, Australian emissions per person have reduced a small amount, but actually there's been very little reduction in emissions from burning oil or coal or natural gas. Australia has the highest per capita emissions and also in this bottom panel has the highest emissions in terms of per unit GDP of any developed country in the world. So Australia's got such a high starting point that even with the Climate Change Authority's recommended reductions or with the government's recommended reductions, Australia is still the highest emitter per person of any developed country and the highest emitter per unit GDP. It's not clear that that is a fair amount because Australia wants a bigger share of the cake in terms of per capita greenhouse gas emissions.

Let's look at whether these bottom-up INDCs are enough to avoid two degrees of warming. Well, there's certainly a reduction in emissions. This is emissions globally. This is where we would be heading with no emission reductions; that's the reductions using existing targets and commitments to emission reductions prior to Paris. It's a very small reduction. There are very large reductions needed and this is what is needed, this is the gap between the current commitments and what is needed to avoid two degrees and this is what is needed to avoid one-and-a-half degrees. There are large gaps here between the current commitments for emission reductions and what is needed to avoid two degrees. That means that even if all countries meet their INDCs, their emissions reductions, even more action will be needed. So the most important thing after Paris is, first of all, for all countries to honour their commitments to reduce emissions and then to review and work even harder, because all countries have agreed to limit global warming to less than two degrees. If that is a real commitment then all countries will need to enhance their reductions.

Here is what the temperature range is with the INDCs and this is what it is with current commitments, 3.6 degrees is the best estimate with existing commitments, 2.7 degrees of warming, but notice that's a mid-range. We don't know what risk that'll be. There's a 50% chance that that will be less and a 50% chance that that will be greater than the greater warming estimates. Realistically, we have one planet. We're not, unless you're looking at either Interstellar or other science fiction movies, going to have other planets to live on in the foreseeable future. If we want our planet to have a climate which is as close as possible to what we've had for all of human civilisation we need to honour the commitments to limit warming to two degrees. These are not my conclusions; these are the conclusions of the IPCC. Yes, the human influence on the climate system is clear, the more we have greenhouse gas emissions the more we disrupt our climate and the more we risk severe pervasive and, in some cases, irreversible impacts.

We have the means to limit global warming, and we're going to hear more about that from Tony a little bit later on, but we can also limit global warming and build a prosperous and sustainable future, and I'm not sure that anyone would object to a more prosperous and sustainable future. Thank you.

ANTHEA HARRIS: I've been asked to talk a little bit about the international perspective about Australia's commitments and really how that all fits together and I thought it might be worth talking a little bit about what we expect the agreement to look like that might come out of Paris.

It's worth remembering that it won't almost certainly look anything like the Kyoto Protocol. No-one is expecting that the targets - and you can tell by the names of them, your Intended Nationally Determined Contributions - will be binding. On the other hand, I don't think that's a bad thing and it would be a bad thing if any countries were trying to stick in the mud about that, and I don't think countries now are because the important thing is that countries want to get on and do things and if the notion of something being binding, even though nothing bad actually happens to you if you don't meet your commitment, if that was a sticking point that that would be a bad thing. It's also worth remembering that it's not the end of some kind of process once we sign up to an agreement in Paris. It's another step along the way. We don't go along to Paris, sign up some things, walk away and we're done. It's another process that we keep coming back and back and hopefully doing a few things that end up ratcheting up the degree of ambition in terms of what countries are actually doing to reduce greenhouse gas emissions.

A big thing that should come out of the agreement, while it'll be up to individual countries to pledge whatever their commitment will be, and we've already seen very large numbers of pledges that are already coming forward about what countries intend to commit to, there will be rules around transparency so that we'll be able to see and track progress along the way. So we'll be able to see what countries have committed, we'll be able to see how they're going towards those commitments, we'll be able to tell how countries are going, that creates opportunities for international discussions, pressure from NGOs, other countries being able to look at each other and have that kind of international peer group pressure which hopefully will lead to better outcomes along the way. That's also related to something that we hope comes out of this agreement, Paris and its subsequent opportunities, to celebrate success and learn from the positive experiences of others. Too many of these conversations have always been framed about burden sharing in a very negative light around trying to get to the slices of pizza in the front row, and actually there are a huge number of co-benefits associated with reducing greenhouse gas emissions. We've had lots of successes.

The general experience tends to have been when people have tried to do things, certainly for Australia we've done a whole load of modelling that says it will be okay, when actually we've tried to do them in practice they've inevitably turned out cheaper than what we ever thought they were going to be when we first modelled them. So providing opportunities to learn from others, celebrate success and giving others confidence to keep going we hope will be part of this new agreement too. So for Australia walking into these negotiations, what do other countries think when Australia comes along? Well, we're a very wealthy country, so compared with just about every other country turning up to those negotiations we are much wealthier than them. We also have extremely high emissions per capita, as David referred to earlier, so we really are one of the people who've been getting to the pizza a lot earlier than others. Australia has also played traditionally a quite constructive role in negotiations about trying to bring people together to try and come up with good ideas. It has really played a constructive role, that's despite having some on again/off again performances on the

international regime – not ratifying the Kyoto Protocol, then ratifying. So I think there's some degree of confusion around Australia's long term position on some of these issues but, that said, our negotiators and the teams that we've sent along do have a good reputation in the international arena.

In terms of our own target, David has already talked about the fact that others have commented on what might be perceived as the inadequacies of the target that the Australian Government has committed to date. It's not regarded by many as being a very strong target. There has been lots of commentary by a number of groups that this is a target that's not at the stringent end and, in fact, it's at the reasonably loose end, which then runs into the question, for Australia and for other countries as well, will we see this ratcheting up of targets? Either in Paris will other countries when they get there put stronger targets on the table than they had spoken about to date, or will they in reasonably short periods of time actually increase the levels of ambition that they had actually committed to in Paris? We would hope, given the fact that when you add up all of these targets they're so far away from the international goal of trying to limit warming to less than two degrees, this ratcheting up of targets and ambition over time is actually important. We don't have much history in this sphere of course, but if we look back that the history that we have it doesn't lead you to a huge amount of optimism on that score.

So countries like Australia that have put down reasonably long term targets all the way out to 2030, there are question marks, certainly in my mind, about whether we actually will change those targets over time. The reason I say that is we look back to the targets that countries put down for 2020. Australia was one of several countries that put down not just a single point target, but a target range. So we did, the European Union did, Norway did, a few others did; no-one increased their targets from their minimum point that they put down in the first place. So Australia's actual commitment still is that it would do a minimum of 5% reduction compared with 2000 levels by 2020, but that it would do more under certain circumstances. The Climate Change Authority has done a report and it went methodically looking through the different things that are in our international commitment. Australia said we would do more if certain things happened. Those things happened but Australia has not increased its commitment for 2020 and it appears very unlikely to do so at this point. So given that's been the international experience to date it will be important to see how the framework ends up to allow for and encourage revisions upwards of targets over time.

That brings us to the issue of policies and how Australia might be perceived in terms of the policies required to meet its target. As David mentioned before, Carbon Tracker said that Australia was the most far away in terms of having the policies in place to be able to meet the target that it's put down. It's worth reflecting on the fact that it's not just Carbon Tracker, everybody is watching everybody else. So if you ask people in Australia what should Australia's target be, the first question is usually, "Tell me about other countries' targets and surely shouldn't we do something comparable to that?" Then, once people hear what all the different countries' targets are, the next question is almost always, "But are we sure they're going to get there? What policies have they got in place? I don't want to hear about announcements or plans. I want to know if they've got the legislation there now, are they are really going to do it?" all of those sorts of things. There's a bit of glasshouses around that of course, so we too, if we're going to expect that of others, need to be in a position to be able to demonstrate how we're going to meet our own targets.

Tony's going to talk a bit more about this, but it's fair to say that the post-2020 landscape is not bare but it's bare-ish. There's a lot of room for some colouring in on that page, it's fair to say. We do have

the Renewable Energy Target, that's in place, we understand and we're getting more confidence that the target that is there is settled. That said, for the rest of the energy sector that's probably one of the blankest bits of the canvas. It's very unclear how the other large planks of our current national policies, so our Direct Action Fund, the auction and our safeguard mechanism, will constrain emissions in the energy sector which is, of course, tremendously important if we're going to achieve the targets that Australia has put down. So that's a bit of a watch this space and there are lots and lots of people, including the Grattan Institute, thinking about what kinds of policies should we put in place, particularly for the energy sector, because it's such a large proportion of our emissions it's an area where we know that there are plenty of things that we can do and so it's always a key focus of attention and activity.

The government has also said that it's going to be developing an Energy Productivity Plan. Again, we haven't got details of that, we're looking forward to seeing what the details of that might be. One thing that has been flagged in concept in a number of government publications has been the idea of vehicle emission standards. Now this is something that most other countries in the world have in place, 70% of vehicles sold into the world are sold into markets that have mandatory standards for vehicles. Australia doesn't have them. Australia's vehicle fleet is really quite spectacularly emissions-intensive compared with other countries. It's getting better, everyone's getting better. Our line seems to be getting bigger. It does seem to be an area where there's some pretty obvious scope for some intervention to bring us a bit more in line with a number of other countries and I think that's definitely in watch this space territory as well. In terms of what we might do in some of the other sectors, the energy efficiency space is of course very broad. Energy efficiency activities are encouraged under the auctioning process, we'll see how much that picks up of itself, but we'll see if there are any other regulatory or other incentive arrangements to promote energy efficiency coming out of that Productivity Plan.

When the government announced its targets it also talked about some other areas that might lead to emissions reductions, so synthetic greenhouse gases. This is actually a small proportion of Australia's total emissions but, again, watch this space, we'll see whether any kind of regulatory intervention in particular might be actually picked up there. Another key thing, not just for Australia but for all countries thinking about how they might actually meet their targets, is the degree to which we say, "Look, we have to do all of this domestically" or the extent to which we say, "Look, we'll do what we can domestically, but we won't limit our ambitions by that, we're also prepared to buy a bit extra from other countries" in terms of purchasing emissions credits or units in some kind of international carbon trading regime. Australia has moved a bit on this. It seemed to be that we were in a position where the government very clearly didn't want to purchase international units. That seems to have moved and we're in a position where it's not ruled out, so that's always something as well that we can keep an eye on to see what the intended balance might be between domestic action, things that have to happen here in Australia, versus things that we might top up by buying international units overseas.

It's interesting, if you have a look at the commitments that other countries have made, what their views about international carbon markets are. Lots of the commitments, the INDCs that countries have put forward, don't reference international carbon markets at all, but some say very specifically that they are hoping for, intending to use these international carbon markets. Another comforting part about that is how many of those commitments reference the fact that if they want to use international carbon markets they say it very explicitly, they want to make sure that they're credible, they want to make sure that they've got somewhere some kind of UN stamp of approval so that there's some kind

of governance around these things, it's not some kind of white shoe brigade selling dodgy credits and allowing people to count them all.

Finally, now that I work for a State Government again, the Victorian Government, they're thinking on a number of fronts about its own climate change policies. The Victorian Government said that it wants to regain a leadership position in terms of climate change policies. There are a number of reviews currently underway of our Climate Change Act; there's an EPA review underway, parts of its terms of reference are explicitly about whether or not the EPA should regulate greenhouse gases; there's a lot of work going on in renewable energy; there was a road map paper that was released recently that talked about having a target of at least 20% renewables by 2020 and considering that target and target for beyond for renewable energy; there's work going on in energy efficiency, the government has said that it will be extending the Victorian Energy Efficiency Trading Scheme. So there's a lot going on there. I must say, from a State Government perspective, naturally enough you want to know what the Federal landscape looks like so that you can sensibly craft state interventions to make a sensible whole. At the moment, because so many things at the Commonwealth level we're not quite sure what they're going to look like for the post-2020 landscape, it does feel a little bit like trying to do a jigsaw when you've got all the pieces but you haven't got the picture on the box. So we're in that stage at the moment of trying to figure out what the State Government policy should look like in an unclear Federal Government landscape.

On that note, I will leave it there and hand over to Tony who will talk to you much more about policy positions.

TONY WOOD: Sometimes when I've been asked to give a speech, like daughters' weddings or whatever it might be, you go looking for "Best Dad Jokes" or something like that. There's not a very big lexicon for climate change joke books, so if anyone can start to dig them up I'd be really interested in a reference. I've got on my desk a very faded cartoon that basically looks to be a middle aged gentleman and his wife watching television and the wife turns to the husband and says, "Well the Australian economy's going really very well, but the planet unfortunately is doomed". And the gentleman says, "Well I'm glad in that case I live in Australia and not on the Earth".

I want to bring this back a little bit, as people have already suggested, to what we might do and I'm not this evening about to recommend what Australia's specific policy should be, but the framework in which this policy is going to take place because it will unfold over the next year or so and I think quite significantly. One of the reasons for that is I don't think you can underestimate the importance of the fact we now have a post-2020 target. We can debate it and you've heard comments about whether that target is adequate, whether it's fair in terms of Australia's fair share. One thing you can be sure of is that a target set in 2015 for 2030 will change. How it will change and how quickly it will change remains to be seen, but I think the very important fact is we have one and then you can start in earnest to think about what will be the domestic policies that might get us there.

Secondly, I think we're seeing increasing agreement on what has to be done. That is a little unusual, and I'll come back to that halfway through this presentation, because we haven't had anything like agreement either within the political sphere of Australia, nor the extent to which a whole other range of stakeholders would agree on the nature of the task. I think therefore there is an unusual opportunity to do something positive in the next little while. There was once what I described in an article a golden hour of opportunity, it was actually a bit more than an hour, in 2007/8/9 when we looked like we were

going to have a Federal Government policy and we didn't. So maybe we are seeing that alignment again, and when policy, opportunity and politics start to align then there's a real opportunity to do something. It may not be very pretty what emerges next, but if it works then I think we should grab it with both hands. So in terms of agreement, this is just recapping a little bit on what you've already heard. There are many things countries have agreed on. They've agreed on this INDC issue. The important thing is that Australia's target had to be more than the pre-existing target and everybody used the 5%, they sort of quietly forgot about the 15-25% although you could argue that we've still done okay in terms of extending the targets.

What's really tricky is the next bit and how people will compare these because every country in the world will argue its national circumstances and, whether or not you are in the front seat or the back seat, people will argue why they should have an entitlement to a bigger piece of the cake. Interestingly however, I think for the first time we're also seeing global businesses that historically would not have taken part in this debate entering the discussion. After the World Gas Conference in August in Paris a number of global oil and gas companies came out very strongly saying the world needs to move on climate change and give us some clear policies to signal how we can invest. Some of those companies are Australian companies and they came back here and said more or less the same thing and only last Sunday a number of the very largest electricity companies in the world have called on governments to deliver some consistent policy so that they can make the investments that are necessary to cause the transition that we need.

This is again reiterating slightly, the first bit is basically what we've agreed on domestically. It's very important to notice that both the major parties of politics in this country agree on these things. Secondly, we do have major businesses – BHP Billiton, AGL and others – who've said publically they support Australia doing what it needs to do to contribute to its share in the two degree goal. We have seen people like the Queensland Resources Council, who represent the large resource companies, saying there is no future for coal and gas unless we can develop carbon capture and storage technologies. The last bit is quite a challenge, but that's what they are now saying, they are recognising that. There is a significant change in language from what they were using ten years ago and even five years ago. Finally, organisations like the Minerals Council, which has been behind some of the largest public debates and public pushbacks on climate change policy, are now saying very clearly that there is a problem. I guess we all know the first thing you are taught in school and so forth when you have to solve a problem, the first thing is to recognise you actually have one otherwise it's unlikely you'll try and solve it.

The Climate Roundtable, which was a grouping of organisations including the Business Council of Australia, the Australian Industry Group, the Aluminium Council and WWF and a couple of other NGOs, have said a number of things about what our policy should look like. To some extent one could argue that looks like saying we're all in favour of motherhood, but the interesting thing is that those groups came together and they all agreed on the words. Now that doesn't mean it's going to be a policy yet, but we are heading in a direction I think which gives one some cause for optimism. So what direction are we heading? This is the Australian version of what you saw from David earlier. It also highlights very clearly why the Australian Government task force that developed the recommendation that Australia's target should be 26-28% below 2005 levels and why it is against 2005 levels is because 2005/6 was the peak of our emissions. So if you want to make your number look good you choose that peak number. I'm not suggesting that other countries don't do that by the way, everyone

will make the numbers look as good as they possibly can and it will be up to people like us to try and bring those numbers back to something that's comparable, as you've already heard David do.

What's interesting is where the lines are supposed to be going for Australia. So if you look at this line here, basically you can see it's pretty much a straight line. If we achieve our 5% reduction of 2000 levels by 2020 and draw a straight line to 2030 you get 26-28%. Now that just means that people spent about six or eight months with a lot of bureaucrats' time when they could have just got a ruler out I guess, but this is the target we developed. This is the target recommended by the Climate Change Authority; it's one that they would argue is more consistent with Australia's fair share of the global target. The thing about this is to some extent people will argue is it fair, they'll also argue is it hard or is it easy, and depending on what you're trying to prove, you will use that sort of language. So when you look at this chart, which is another way of looking at some of those things that David put up, what you can see here is compared to some developed countries – I'm not comparing us with some of the rapidly developing economies, like China or India, who are just about off the chart in most of these numbers and it's very important that they take action as well. But if you look at these numbers, these are the numbers in terms of percentage reductions and you can see very clearly that Australia is doing nothing like as much in terms of our promise compared to the US, Canada and EU, and that's partly because, as David said, our target is framed in 2030 rather than 2025 terms.

In terms of targeted reductions per year it's not insignificant, maybe not as much as the US is proposing to achieve, that's if they can get all this through their various legislative challenges. But by comparison with these other countries we're doing a fair bit and one of the reasons is of course because our per capita emissions start off pretty high and even by 2030 they're still relatively high, particularly if the world's arguing that everybody in the world by 2030, which is presumably going to be somewhere between 7 and 8 billion people, should have an equal piece of that pie. That's when it gets interesting because no-one actually says this, but often the argument they use is that some of us are entitled to more of the pie than others. For example, one argument is that with the activities that we do in Australia that produce greenhouses gases, we are producing more economic wealth in our exports for other countries than other people are, therefore we're entitled to have more emissions in this country. Alternatively, we're coming off such an incredible resource base, we have been a resourced-based export economy, it's going to be hard for us to reduce our emissions and therefore we should be allowed a little bit more leeway than others, for whom it's a lot easier. Those are the sorts of arguments you will hear, particularly as we debate the sort of policies that are going to unfold over the next 12 months.

There is, generally speaking, a preferred plan. The OECD said this is what countries should do. The trick is nobody does it. As far as I know, there is no country in the world who has actually done this, that is put a price on carbon to start with and then don't fiddle around with it, don't add a whole lot of other policies which are fundamentally unnecessary or distracting. Only add those policies that really do address the areas where your fundamental central carbon price doesn't work. There are all sorts of reasons for this, one of the reasons is I would suggest people don't like having a very visible carbon price. Most of us would argue wouldn't it be good to have a very simple number that's the price that we need to pay to reduce greenhouse gas emissions? The answer is, if you've got one policy that produces that price it's very visible. If you have ten policies that all do little things separately it's much harder to find the price. Therefore politicians, generally speaking I would suggest, actually prefer the latter rather than the former, even though they will often say the opposite. So what we have is this mess.

We have a situation where we are arguably the only country that's actually repealed a major piece of climate change legislation. We have a Renewable Energy Target which has been tossed backwards and forwards so many times it must get dizzy. At the moment there is some optimism that it might actually be stable, but the debate now, and you may have seen some of this in the media, is whether it can now be achieved because we've stuffed around so long putting it in place and making it firm, and there is still some debate as to whether people will game that system. We do have a situation where the current government has a plan or a policy mix which will probably be consistent with getting us to 2020. I should point out, by the way, coming back to this chart here, that if we start here, which is where we were at the beginning of this year – and these are the projections published by the Department of the Environment - this is where I was suggesting the projections were going to be. If we look at this wedge between 2020 and 2030, that's about 2 billion tons we would have to get out of the atmosphere between 2020 and 2030. But if we do achieve our 2020 target and we still keep doing this then that wedge we have to get out is about a billion tons, 900 million tons. So actually achieving that 2020 target becomes quite important.

The challenge at the moment is can we put in place some domestic policies that might actually get us there? I would suggest it's highly unlikely that we're going to see anyone any time soon seriously argue for an economy-wide cap and trade emissions trading scheme despite the fact that most advisors to governments would say that's the best way to go. That's not that what we're likely to see. You've already heard, I'm sure, the ALP basically jumping around trying to work out what they're going to say and I've got no idea what they're going to say next, but they haven't quite worked out what it will be. The current government has got a series of policies that may very well be able to be re-engineered to become something of substance post-2020, but they've kicked most of the hard decisions down the road. As Anthea said, they really haven't bitten the bullet of what they need to do with electricity systems and they haven't bitten the bullet of what they do need to do with the concept of a safeguard mechanism, which is supposed to safeguard us against breakouts and emissions but basically isn't designed to do that and quite deliberately so for a while yet. So there are some things that could be done but they've got some way to go.

So I would suggest, in summary, the way we are now towards the end of 2015 as we head into the Paris conference is we do have good news, we do have a post-2020 target. The target is less than it should be but it's probably more than it could have been. I think many people were a little surprised that the government didn't come up with a much lower target. In our view, and I think in many people's view, an explicit carbon price is by far the best way to go but that is hard to do because of the messiness we've had politically over the last four or five years. Therefore we need to think about something which might be a messier outcome but could still deliver something. We have to start from where we are. I don't think it makes any sense at all for the Labor Party to basically say we're going to chop it all out and start again, which is more or less what the current Liberal Coalition Government did. That would be, I think, an ugly place to be. Industry is looking for far more credibility than that in terms of how we move forward. I think it's critical that we achieve some degree of bipartisan support because without that you're not going to get the changes necessary in terms of long term investment.

So to some extent, and you always make these sort of statements with a little tinge of regret, I think that second-best policy that actually gets implemented as it always is might actually be better than first-best policy that never does. Thank you.

TOM ARUP: As is customary at these events, there will be time for questions from the audience and we should probably have about 25 minutes to do that.

Just as a starting point, I might start with David, if we go back to your graph about global emissions and how they have to track towards two degrees, of course the squiggle gets right to the bottom, in fact it hits zero, and that's not something that people talk about a lot. In the national debate we're having a conversation about 2030 and where we have to get to there but, of course, 2030 is not the end goal here, we have what's called decarbonisation and it's a word that's increasingly cropping up in a number of the discussions, quite notably the G7 put out a statement during the year saying that would be the ultimate goal. The IPCC in their fifth assessment painted a little bit of a picture of what that might actually look like.

Could you maybe tell us what decarbonisation actually means and how that might be achieved, given there are emissions that we probably can't get rid of or we can't control?

DAVID KAROLY: Yes, I will try to paint a picture. A decarbonised world has been described and there are a number of different ways that that can be achieved depending on choices that different countries make.

Decarbonisation of the electricity sector means a combination of a range of zero carbon energy sources, so that can be primarily renewable energy or it can be energy produced from burning fossil fuels as long as 100% of the carbon dioxide emissions from those fossil fuels is captured and buried. And that technology of 100% carbon capture and storage from burning fossil fuels does not exist yet and most estimates indicate it's expensive. Another possible source is nuclear power, which is currently used in a number of different countries as well as being phased out in some countries because of the risks of the leakage of radioactive waste. So those are energy sources, but there are in fact many, many other sources of greenhouse gas emissions into the atmosphere in addition to direct electricity production. Most of us will still want to eat food to stay alive and that leads to greenhouse gas emissions and there are no known sources of producing zero emissions directly from agricultural production because fertilisers, growing crops, animal agriculture all produce emissions.

There are some possible solutions, which means planting more trees, changing agricultural production, capturing some waste material and using that to produce energy as well as growing more trees or producing biofuels and then capturing the carbon dioxide, so essentially what's called BECCS (bioenergy and carbon capture and storage). It's not take a Bex and lie down which your parents or grandparents might have done, this is use BECCS and lie down and save the carbon dioxide. There are also, and it's critically important, ways that we have to change our transport systems so that they're not using fossil fuels and that means electrification of all forms of transport, not using cars that are fuelled by petrol or diesel. All of this is possible but it doesn't appear to be a large part of either Australia's national policies or many policies around the world. The date, the timescale that we're talking about decarbonisation of the energy systems and the transport systems and going to negative greenhouse gas emissions in some ways is within many of our lifetimes. It's 2050 or earlier for developed countries. That's not very far away, that's 35 years. The infrastructure to have that available need to be being built now, not planned in the future.

TOM ARUP: Thank you David. So given that's the long term challenge and we have at least one intermediate step put down by the government towards that, the Environment Minister has said on a

number of times the Direct Action Scheme is here for decades. If you don't know how the Direct Action Scheme works, and I'm sure most of you here do, there are two essential parts, there's an emissions reduction fund where emitters pay or can bid in through an auction system to get paid to reduce their emissions for a range of projects, but then there's a second measure called the safeguard mechanism and this is supposed to start putting some caps on effectively the largest industrial emitters in the country. The Environment Minister says those caps or those safeguards are here for decades and they will be the basis of our long term transition towards this end goal.

Do you believe that's the case? Do you believe that's possible? Do you believe that's the right mechanism? If not, Tony, as you alluded to in your talk, if that's the one nominally legislated tool we've got at the moment, how would you reform it to turn it into the kind of thing that would drive the change that we're talking about?

TONY WOOD: Let me have a go first because Anthea knows much more about this than I do and she'll correct me on a few things, but I think for me the trick here is that I don't believe anything. Someone was reminding me that one of their parents has a group that gets together every month and they meet to discuss, Warmers and I suspect those of us who are on the stage tonight are Warmers. It's used as a derogatory term, by the way. So when you think about this belief issue the question to me is are we starting to find a situation which the policy framework would give some credibility to head in the right direction? I've got absolutely no idea about any of those technologies that David talked about will ever deliver the sort of outcome that we've been talking about in response to Tom's question. Only five years ago the two things that were going to save the electricity sector were carbon capture and storage in geothermal and neither of them have made any progress in the last five years, but solar has. So who knows what's going to happen next, but the issue is to get started.

So I think the really positive thing here is whether you like the policy or not, and I don't happen to particularly like it, it is in place, it can start to work. The Emissions Reduction Fund, paying people through an auction to buy stuff, is a perfectly valid way to achieve change. It's on budget, so it's nasty from a Budget perspective, but Joe Hockey's not Treasurer anymore so maybe the Treasurer we have today will actually think this is a good idea to spend all this money on buying emissions reductions from somebody. If you had enough money you could certainly do an awful lot and most people I suspect if you live in Melbourne bought their house at an auction. It's not necessarily a bad way to do things, to buy and sell stuff. Secondly, setting the baselines in the way the current government has done does leave the opportunity to tighten those baselines in the future. The trick is that that scheme is a bit messy, setting baselines is hard, putting it all together so it actually heads towards a firm target, a cap which you'd put under a cap and trade scheme, is also hard.

So for me the answer is yes, I think this is a place to start, you can't start anywhere else so therefore let's start here, but let's see how this develops. And I think what we need to see is the community, the people who vote for the politicians but equally business saying, "Right, we need now to see this credibility around these things you've designed". Theoretically they could be done, but we now need to see some really tangible moves to make sure that they do because at the moment I don't think they do much post-2020, at least as yet.

ANTHEA HARRIS: I won't offer corrections, but I'll offer some additional thoughts. So if we think about the two arms of the current policy, there are the auctions, buying credits, and how that works is that there are these rules about how you can get credit for reducing emissions. So the methodologies

all work some version of this that my emissions were otherwise going to be here and I've done this thing and now they're going to be here and I get a credit for the difference and I can offer to sell that to the government, so that's my beginners guide to that arrangement.

In terms of the scope that mechanisms like that could play for the long term, I think we've had a worldwide largescale experiment with that kind of paying for credit arrangements and I think the conclusion internationally is that it's very difficult to do those things to scale. They're good for some things, they will encourage some nice things, and that's good. So the clean development mechanism, that's our big largescale international experiment, that's really the system where poor countries can create credits, rich countries will buy them to help them meet their own targets, there's a whole international community running around in a flap going, "How can we build this up to scale? It's never going to get us completely where we want to go". And, if you think about it, for a long term proposition just looking at that alone a position where the government buys its way to decarbonisation as a long term proposition, that's not going to work.

So then we look at the other arm of where we are today and we have a look at the safeguard mechanism. As Tony's alluded to, basically there are some limits on what our very largest emitters are allowed to create and if they go over that limit they will need to offset that in some way or pay a penalty. Now the way things have been set up to date those limits aren't very binding, I think it's fair to say, and for the electricity sector as a whole there's a communal limit and then only if the communal limit is broken do you have any limits on any individual ones. Again, hard to see as it is now how that's going to be a big constraint on emissions. If you start to think about how it might evolve to something that does constrain emissions, lots of versions of how it might, just as technical options, how it could transform into something that actually binds start looking suspiciously like a cap and trade emission trading scheme which is, of course, the thing that we had that we just got rid of. Or you could have lots of variations on a theme, but something that binds, something that if it's going to binding you think I'd like to have some flexibility in that, some kind of transition path does start looking suspiciously like some of the things, at least some kind of relation to, possibly a little bit distant in the early stages, what we may have had in the past.

TOM ARUP: We've got about 20-25 minutes for questions from the audience. Please try and form it into a question rather than a statement and keep it brief, and hopefully the panellists will also keep it reasonably brief in terms of answers so that we can get through as many questions as possible.

AUDIENCE: In the calculation of all the greenhouses cases for carbon emissions, is any account taken of carbon emissions from natural phenomena? And, in an increasingly warm world, is it likely to be exacerbated by fires and other things that we are witnessing? And to what extent will this turn into a positive feedback mechanism which, as a control engineer, I know it to be a dangerous thing and what will be its effect?

DAVID KAROLY: That's a really good question which I could spend the next week trying to answer, but I'll try to keep the answer short. So when we talk about greenhouse gas emissions in the budgets that I talked about they're really greenhouse gas emissions from human-related activities only. Natural emissions have been in balance over the last thousand years or so and are significantly larger than the human-related emissions, but adding the human-related emissions has led to a significant increase in the greenhouse gas concentrations in the atmosphere. As I mentioned before, from 280ppm being the highest level over the last million years, except in the last 100 years where we've

seen the concentrations grow from 280ppm to 400ppm due to this cumulative growth in human emissions adding to concentrations in the atmosphere.

The second part of your question was related to really this possible change in natural emissions due to human activity and there are a number of ways that a warmer climate system can lead to both negative and positive feedbacks. So let me talk about the negative feedbacks first of all. Warmer climate and higher carbon dioxide can lead to more vegetation growth in previously colder climates. So trees and plants will grow better in a higher carbon dioxide environment, in areas that were previously cold the growing season gets longer, and there's plenty of evidence of this in the high latitudes in the Northern Hemisphere where trees are growing more, forests are spreading poleward and taking up more carbon dioxide. That's a negative feedback. That's potentially a benefit from climate change if you live in those areas. However, in many hotter and particularly drier areas warmer temperatures lead to loss of carbon from soils and also greater frequency of fires, burning forests, and also can lead to release of carbon dioxide and methane from previously frozen ground, melting of permafrost or melting of what are called methane clathrates in the ocean. Some of those positive feedbacks are taken into account in those temperature estimates, but not all of them are.

So the situation could be significantly worse than scientists have talked about if, as Donald Rumsfeld would say, the known unknowns were taken into account we could be a lot worse off.

AUDIENCE: I'm in the HVAC and refrigeration industry, we represent conservatively 11.7% of Australia's emissions, probably more likely up to 18%, so we're kind of a dirty industry. But we can fix it if we took the same approach that Denmark took when Svend Larsen in his announcement in 1996 converted Denmark to natural refrigerants. They're all more energy efficient than the current synthetic refrigerants, they're all environmentally benign. But we are a tiny, tiny speck in a massive industry with a lot of corporate money and corporate weight against us, how do we get the government to sit up and listen to what are realistic and sensible solutions within our industry?

TONY WOOD: The answer to that partly is if you've seen the history of some of these industries that have started to have some impact, I mean, Anthea's already referred to emissions standards and so forth. The only way this is going to work I suspect is that when you look at the numbers this is what makes up our emissions, so much comes from electricity generation, as David said, so much comes from combustion of other fuels etc. some comes from agriculture. All of them have to be to the point where they're approaching net zero in the timescale we're talking about. The only way this is going to work is if we have policies that are a combination of putting a price on carbon which will cause a lot of the change, much, much more than we've thought about at much lower costs than we've anticipated, as Anthea said.

Secondly, in some cases it will be by regulation. That is insisting that we have better regulation on the standards of the air conditioners we import, the motor vehicles we import and so forth, because I think that's going to be the other place. And I think there are going to be situations where industry associations such as your own can start to put those numbers in front of government, because my suspicious is that as they try and make the numbers add up this will become much more important.

AUDIENCE: The Synthetic Greenhouse Gas Levy did make the industry slightly turn, but not one penny of that money collected went to the government because the chemical companies imported all

of that product six months prior and when it was repealed not one penny went to the industry or the government.

TOM ARUP: We might leave that there and take that as a statement.

AUDIENCE: Anthea, you said that we are quite a long way behind in managing emissions from cars in reference to other countries in the world. Could you give us an example of a country which is leading edge in managing car emissions and what sort of technology they use that we don't?

ANTHEA HARRIS: When you're talking about who's at the leading edge on vehicle emissions you're normally talking about Europe which has the most stringent emissions. That said, even the US, the famous gas-guzzling US, they're significantly better than us now and with the policies that they've already announced for where their standards are going to be going down to, the gap between us and them will increase significantly as well. Most countries have them, China has more stringent standards than us, so there are lots and lots and lots of countries in the world, most countries have these kinds of standards and we have many, many examples to look to. We know there's a way you do these things, we've got plenty of examples before us about how to do it, so in terms of meeting the standards there's a well-trodden path ahead of us.

There are a couple of things going on here. Why is Australia's vehicle fleet so much more emissions-intensive than other comparable countries to us? It's probably a mixture of two things. One, Australians express through their purchasing habits a preference for some larger and in some cases more emissions-intensive vehicles, so there are some things that Australians choose to buy, there's a preference for them that are more emissions-intensive. The other thing that's going on, we don't know exactly the dividing line here, but it does seem to be the case that Australia, because we don't have standards, if you've got vehicles that you want to sell, if you've got engines that you want to sell that are not that efficient, do you shut down that factory line producing those vehicles, do you shut down the factory line producing those engines that you can't sell anywhere else anymore, or do you sell them to a place like Australia that will still take them? There seems to be a bit of that going on as well.

In terms of the technology, there's lots of technologies and it's very important to note that the way these standards get implemented everyone doesn't have to go running around in some Fiat Bambino tomorrow. There's a huge amount of flexibility in the way that you can create these standards so that it works on an average and you want the average to go down over time. So there are lots of different technologies, there's light-weighting, low-rolling resistance tyres, better engines, diesel, there's a whole host of things, all perfectly known technologies, nothing strange and weird, that you can put into cars to make them more energy efficient. It's really about putting these standards in place that give the purchaser, so if you're Toyota or Mazda or whoever you require on average to meet certain limits. That's how it works in every other country and that's how it could work here.

AUDIENCE: This is a question for David Karoly, the question that doesn't seem to be revisited is whether +2 degrees is a good target or not. James Hansen, former NASA scientist who I'm sure you'll know, suggests that scientists in the '80s said let's set a target of +2 degrees because they thought that for sure governments around the world would do things in the interim to make sure we didn't get anywhere near it. James Hansen says that +2 degrees is a recipe for disaster because it gives us a global mean temperature we haven't seen since the Eemian. Was James Hansen wrong?

DAVID KAROLY: No. There has been a lot of discussion amongst many different communities and many countries, particularly small island states for which two degrees of warming the last time that the planet was that warm had 25m higher sea level and that puts many small island states at about 10m below sea level and underwater. So, 25m of sea level is very, very dangerous for a billion people. More than 10% of the world's population, their current habitation is underwater with two degrees of warming over an extended period. So it's not safe. We also know if we come down to Australia that we are already getting significant increases in bushfires, significant increases in hot extremes, significant changes in rainfall patterns, significant natural extinctions with just one degree of global warming. And so you double that and the responses are non-linear, the changes will be much more dramatic. So two degrees isn't safe, it's very substantial, and that's why many countries in the world are arguing that one-and-a-half degrees of global warming still isn't safe, but it's better than two.

One of the things that the Carbon Tracker project is trying to do is to look at what additional greenhouse gas emission reductions might be achievable to stabilise temperatures at one-and-a-half degrees. Or to go from two degrees to then continue emission reductions, continue negative emissions, so that carbon dioxide can be sucked out of the atmosphere to return to a climate which is going to cool on an ongoing basis to something like preindustrial temperatures. But that is a much, much, much harder target than two degrees initially.

AUDIENCE: Just to go back to the Paris negotiations, Andrea, you mentioned the need for a framework that will ratchet up ambition. Does that exist within the current process or can you speak to that?

ANTHEA HARRIS: I'm just trying to remember now. There's a thing, it's called the no backsliding kind of thing that people have agreed on to date, so we hope that that gets a formalised spot in the Paris arrangements. As I said, there's that difference between the no backsliding, so no going backwards, but that's not quite the same and there's an important distinction between being encouraged to okay, I'll put that down for 2030 but I'm going to come back and revise that and go downwards. So there's nothing there yet, certainly nothing requires it and no-one's been talking about requiring it, and it'll be a question about how successful we are in being able to actually encourage it because, as I said before, in the past we didn't.

DAVID KAROLY: If I could just add to that, there is in fact in the draft Paris agreements a five yearly review of emissions and climate and the opportunity, encouragement for countries to review their INDCs and, in fact, change them. There is no formal requirement to upgrade them, but there is certainly this five yearly review and process to upgrade the INDCs.

TOM ARUP: And part of that is also that not only is there a review, but there are also processes within the UNFCCC process to force countries to explain their positions. So you saw this recently with Australia at the meetings that were held midyear, they actually came in for some very tough questioning, at least in my opinion and, I guess, in some other observers' opinions, about their 2020 target and some of the domestic policies that sit behind that. So while there's no formal requirement that when you go to a review in five years that you should up your target, at least in what looks like the agreement's going to be in Paris, the idea is that you'll be basically peer pressured into doing it at some point into the future. Whether that works or not I don't know.

AUDIENCE: A question for the panel overall, a lot of what we've been hearing about seems to be about negative consequences if we don't meet the targets. Is there any thought to creating within Australia and, even better, globally some positive consequences to meeting targets, actually really looking to celebrate success? Because I don't see in this space a lot of celebration of success and there has been some considerable success.

DAVID KAROLY: You're absolutely right, both Anthea, I think, and Tony talked about some of the fantastic successes with the encouragement for the introduction of solar panels in Australia. There was an expectation that it would take ten years to have a million households introduce solar panels and that happened in about three years, not ten years, and the growth and uptake of both solar hot water and solar PV systems on houses in Australia has been at a faster rate than any other country in the world. So that's a great success. There are also many other opportunities and benefits for introducing a low carbon economy. There are enormous health benefits, first of all, from phasing out both coal mines and fossil fuel generated electricity and fossil fuel driven transport systems because they produce dangerous air pollutants, both particles and other pollutants, as was demonstrated in the Latrobe Valley fires a couple of years ago. Digging up coal and burning it is dangerous for people's health not because of the carbon dioxide, just because of the direct sulphur emissions. So we can get a cleaner, healthier environment by not burning fossil fuels.

There are also co-benefits from having local distributed electricity sources. It produces more jobs in regional areas through having distributed electricity sources than it does from having concentrated electricity sources and regional improvements in employment are something that most people would be favourable for, except some of the large electricity and mining companies but that's probably understandable. So there are many, many benefits and I can go and talk about more. There are benefits from having green roofs and more trees in cities because it actually makes the cities cooler, it takes up carbon, and actually make the cities nicer to live in. All of those are co-benefits from approaches to reducing greenhouse gases through carbon capture by trees and makes the cities more habitable. There are many good things that can come from a low carbon economy.

TONY WOOD: I think the point you raise is illustrated in the mess we've got into to some extent because when people gave up on communicating why essential policy which was going to put a price on emissions was seen to be too negative it was portrayed as a Carbon Tax, that was a very successful negative campaign right? The positive side of it was people were given incentives by State and Federal Governments to put solar PV on their roof and they did, literally 1.5 million of us. So you can see how that story can play out. One of the tricks here is that there is when you get electricity from solar it's still electricity, it doesn't actually provide you much direct utility. You've got to look at the other things David has been talking about when you start to eliminate some of the other negatives from the way we've been producing our centralised systems to date.

So I think it can be, but I think I'm a bit more optimistic now that we may see more celebration of opportunity, there's never been a better time to be alive in Australia, all that sort of language leads to a more positive environment maybe as well.

AUDIENCE: A few weeks ago China committed to 60-65% emissions reductions of 2005 levels by 2030 and the US and China committed to a shared vision for the Paris conference. Do you think that will produce a more positive and ambitious result?

ANTHEA HARRIS: China and the US obviously are the two big elephants in the room. It can't be a success without those two countries and the fact that they have been willing to speak early about what they're prepared to do and to be actively seen to be cooperating on this front can only be a good thing. It's interesting in Australia how some of that plays out. So some of those celebrate successes and think about some of the co-benefits that you might get from reducing emissions.

There are some weird discussions that happen here in Australia. So if China, which it does, wants to reduce its use of fossil fuels, coal in particular, because of health concerns, very real health concerns about the quality of its air, somehow some of that translates to Australia as they're actively doing this, they've got a gigantic renewables program, a gigantic nuclear program, these things are huge, they're spending a lot of money, they're doing all of these sort of things, but in Australia that plays as, "Oh, but they just wanted to do it anyway so it doesn't count". I find that just bizarre. Similarly, in the US, "But they found all that shale gas". So there have been a lot of studies that show that actually shale gas hasn't been that big a driver of emissions reductions anyway, it's a bit of a myth, and to get to their targets they're going to have to rely on a lot more than just subbing out a little bit of coal for gas. There's going to be a whole bunch of things that they're going to need to be doing that they are putting in place and that they have in place now. Somehow that gets translated here in Australian conversations as kind of cheating as well, I'm not quite sure why.

So it is very important. Are China and the US doing enough to be putting us on a two degree path? No, no-one is, everybody needs to do more, but it's certainly a heck of a lot better than not having those two giant players cooperating.

AUDIENCE: I want to lift the discussion above the local here, Australia. Why are we giving fossil fuel subsidies? Is that going to be discussed at Paris? And the second thing is, apart from carbon dioxide, what about black carbon? I'm wondering, we've had all these Indonesian peat fires recently closing schools all over Malaysia and so on, this is another climate forcer. Could you talk a bit about black carbon? That's what I'm really interested in, but the old chestnut of fossil fuel subsidies, could you talk about why we don't do it?

TONY WOOD: The biggest fossil fuel subsidy is the fact we don't include in the cost of burning fossil fuels the environmental damage that it causes, that's the biggest fossil fuel subsidy we've ever heard of. The IMF has done the numbers on this and it's in the hundreds of billions of dollars per year, it's a non-trivial number, in fact I think it might be in the single digit trillions. So there is a significant subsidy there. In Australia there have been various forms of subsidy supports for a whole range of things including various forms of mining and exploration for fossil fuels and there remains a significant diesel excise rebate exclusion in certain sectors. Other than that, we don't have some of the direct fossil fuel subsidies that many other countries have, but the biggest one I think is the first one and that's why it becomes so important to put that price on carbon because otherwise we are continuing to kid ourselves in how cheap our electricity is, for example.

DAVID KAROLY: Black carbon is essentially associated with the particulates that are produced from low-temperature burning of fossil fuels. It's essentially just soot, but if it gets into the atmosphere it causes all sorts of health problems and it also causes warming of the atmosphere because black material absorbs sunlight, warms the lower atmosphere. It has a relatively short lifetime and it gets washed out when it rains. So when the fires stop or when it's raining this black carbon basically is washed out of the atmosphere, as happens with most air pollutants. So you're absolutely right, black

carbon is a major warming issue, but it's a relatively short term warming issue, whereas carbon dioxide doesn't get washed out. Carbon dioxide has a long term effect in terms of increasing concentrations and then it takes thousands of years for natural processes to remove the increasing concentration associated by emitting carbon dioxide into the atmosphere. There's a big timescale difference and that's why the focus is often on carbon dioxide, because of the long time it takes for natural processes to remove that carbon dioxide introduced by human activity.

AUDIENCE: What about Paris?

DAVID KAROLY: The emphasis in Paris is primarily on long-lived greenhouse gases, rather than on the air pollutants associated with things like soot and black carbon.

TOM ARUP: We've just run a little bit over time so we might call it there. I'd like to thank our panellists, David Karoly, Anthea Harris and Tony Wood.

END OF RECORDING