Brisbane – Demand for coal and gas in light of the Paris Agreement – what this means for Australia

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Australia signed up to the Paris Agreement in December 2015 that committed to holding the increase in the global average temperature to well below 2 °C above pre-industrial levels. The USA and China have ratified the Agreement. Australia signed the Agreement in April and is committed to ratifying by the close of 2016. The International Energy Agency's World Energy Outlook report indicated that if the world's governments meet this commitment, then the global demand for coal and gas follows a very different path from that contemplated in the 2015 Energy White Paper and in the planning of many Australian resource and energy companies. In this State of Affairs event co-hosted by UQ Energy Initiative and Grattan Institute, a panel of experts presented and discussed with the audience a range of perspectives on what this means for Australia's economy, its businesses and policy makers.

Moderator: Professor Karen Hussey, Deputy Director, Global Change Institute at University of Queensland

Speakers: Professor Peta Ashworth, Chair, Sustainable Energy Futures at University of Queensland
Sandra McCullagh, Head of Environmental, Social & Governance Research at Credit Suisse
Mick Buffier, Chairman, World Coal Association
David Blower, Energy Fellow at Grattan Institute

KAREN HUSSEY: Good afternoon one and all. My name is Karen Hussey, I am the Deputy Director of the Global Change Institute at the University of Queensland and it's my very great pleasure to be the moderator for this evening's event. First and foremost allow me to give you a very warm welcome to this *State of Affairs* event, an event co-hosted by the Grattan Institute and the University of Queensland's Energy Initiative. Allow me also to acknowledge the traditional owners of this land on which we gather and pay respects to their ancestors who came before them and to their elders past, present and future. They say an engaging event is one that is topical, a source of contention, highly political, ideally with an existential element to it and, lastly, there should be just a smidgeon of ideology evident to spice things up a bit. So what a treat we're in for.

In all seriousness though, tonight we're talking about what the future of the coal and gas industries look like for Australia in light of recent commitments to tackle climate change. As you know, nearly 12 months ago the International Community of States, including Australia, signed up to the Paris Agreement which saw a commitment to hold the increase in global average temperature to well below 2° above pre-industrial levels, but ideally to hold global average temperature to 1.5°C. Immediate concerns arising from that agreement have centred on how we can effectively and fairly decarbonise our economies and ways of living to meet that commitment. So too we're grappling with how quickly that transition must or should occur, and recent events in South Australia have raised important questions about the speed with which climate policy and especially the shift to renewable energy is occurring. Are mistakes being made that we haven't thought carefully about the right energy mix that we need moving forward? Do we know how much time industries and societies traditionally

need in order to adapt well to profound structural change? Are we in danger of throwing the proverbial baby out with the bathwater in our haste to deal with climate change?

I suspect all of these questions will arise tonight and hopefully they'll be answered, but in thinking about them it might be instructive to very deliberately appreciate the timescale from whence the issue of climate change has arisen. If you're a climate change scientist, in the grand scheme of things we are not acting quickly at all and history is instructive. The Greenhouse Effect was discovered by an Irish physician by the name of John Tindall in no less than 1861. One hundred years of science later the first official report of concern was delivered to the US President's Advisory Committee. It said the following, "Through his worldwide industrial civilisation, man is unwittingly conducting a vast geophysical experiment. Within a few generations he is burning fossil fuels that slowly accumulated in the Earth over the past 500 million years. This may be sufficient to produce measurable and perhaps marked changes in climate and will almost certainly cause significant changes in the temperature and other properties of the stratosphere". This is 1965, ladies and gentlemen. The report details the possible effects of an increase in atmospheric CO_2 with extraordinary clarity: melting of the Antarctic ice cap, rise of sea level at 40' per century, warming of seawater, increased acidity of freshwaters and an increase in photosynthesis. At the time the report's findings were overshadowed by concerns about point source pollution in air and water, but with the benefit of 50 years' hindsight the timing and thrust of its message is quite remarkable.

They also say that an informative event is one that draws on recognised expertise delivered well. With that in mind, tonight we have a terrific line up of speakers, all ready, willing and more than capable of talking about the implications of the Paris Agreement for Australia's economy, its businesses and policymakers. Our speakers tonight are Sandra McCullagh, Head of Environmental, Social & Governance Research at Credit Suisse, Professor Peta Ashworth, the Chair of Sustainable Energy Futures at the University of Queensland, Mick Buffier, the Chairman of the World Coal Association, and David Blower, who is an Energy Fellow at the Grattan Institute with many years' experience in the energy sector. Now, allow me to talk to you about format. To begin with, each of our speakers will share their views on the subject, no doubt they will share those views both eloquently and succinctly - anybody who exceeds the five minute timeframe shall be punished severely! We'll then move to a lively discussion amongst the panel for a number of minutes before opening up for audience questions. I'm aware that we have a very informed audience tonight, so I look forward to fielding lively and interesting questions from all of you. Now, without further ado, allow me to introduce our first speaker for this evening, Sandra McCullagh.

SANDRA MCCULLAGH: Thank you for having me. Can I also introduce Zoe Whitton down the front here, who is the other half of the team? We've just published a 90 page report, so I've got five minutes to give the essence of that, but hopefully I can do it because it's quite a simple concept.

Our clients at Credit Suisse are institutional investors, they are fund managers and superannuation funds, the people who are managing your money, and they've been coming to us saying, "We've been asked to do carbon footprinting on our portfolios. We've been asked to exclude carbon and certain assets from our portfolios" and seeking help on this. So after a long iteration we wanted to look at what did a 2° scenario look like for Australia, so a consistent modelling scenario right across the economy. So we chose to use the Decarbonisation Pathways work by Climate Works, ANU and CSIRO and we came to the conclusion that basically not all carbon is equally risky. Our clients were being asked to look at, say, Scope 1 and Scope 2 emissions and that was all the information they had

when they looked across their portfolios, but that wasn't really telling them where the risks were if they've got a portfolio of 100, 200, 300 stocks that they're managing on behalf of their clients.

We came to the conclusion that the greatest risks were actually downstream. So for a company, if you had substitutes for your product and people could make choices to not buy your product then you had huge revenue risk. So the concern was that if you're a company and you've got upstream emissions, so you're buying electricity, that's captured in your Scope 2 emissions, then you can make choices. You can usually choose to go and buy renewable energy, so long as you haven't signed a 20 year PPA, that used to be pretty fashionable a few years ago, in which case it's going to take a bit of time before you can work your way through that. So upstream you had choices to reduce the carbon emissions of products you were buying. In the company's own processes, often, if you're particularly not a capital-intensive type industry, you can decarbonise your own processes. Equally, if you don't do that some of the competitors will come in with lower cost, lower emission type products and you're going to face more risks than if you can wind your way out of the carbon intensity of your own processes. So those are the Scope 1 emissions and our clients were being presented with data that just looked at those emissions in your own processes and the emissions upstream. There is no way to capture any sort of reliable information about your downstream emissions and that's where we think the risks are.

So if you're a company and you're selling a product that is substitutable, so people can make choices and move away from that, that's where we think the risk sits in investment portfolios for our super funds and there is no reliable way for these super funds to get that sort of data or measure it. So we've taken a look sector by sector across the Australian economy and come up with four types of companies. Those we say are in "existential risk" and basically we believe that's the coal and oil and gas sector - so I'm looking forward to the conversation two speakers on – and we believe that their entire revenues are at risk. There's a sector we call "high investor engagement", so they're where you think the company might be able to adapt, so some of our resource companies can adapt, they are not single resource companies, they have more than coal in their portfolio. So we're asking investors to seek active engagement with those sorts of companies so that they can be confident that those companies can adapt, and if they're not comfortable then that's probably where they'll be exiting those out of their portfolio. The third ones are ones that are policy dependent, and I think David will have a lot to say on this, so their revenues rely almost entirely on policies set by government and the stability of those policies. So, for example, if you're in the renewables and biofuels area you are policy dependent and that's where the biggest risk sits in Australia, is that policy part. The final ones which our investors love to know about are those we call "the resilient upside". So it doesn't matter what governments do, what policy comes around, they are going to have resilient upside.

To sum this all up, I'll use the example of a company like CSR. If you were an investor, a fund manager, and you're being asked to look at your Scope 1 and Scope 2 emissions then I can tell you CSR looks pretty dreadful. There'd be a lot of pressure on you to reduce the Scope 1 and Scope 2 emissions in your investment portfolio and you would think about exiting an investment like CSR. But if you look at it from downstream, CSR makes products that are going to probably flourish in a 2° scenario, aluminium, glass, and they're adaptable, they will come up with more and more products that are going to suit a 2° scenario, so they're not the sort of company you would want to be automatically excluding from your portfolio. So that's kind of a summary of what we're looking at.

KAREN HUSSEY: Fantastic and on time. Well done. Peta, she has set the bar.

PETA ASHWORTH: Okay, I'm really nervous because I love to talk! Thank you Karen for having me here. It was interesting to hear the perspective on industry. I've skimmed the report, I haven't read it in depth, so I'm looking forward to engaging it, but as the social scientist on the panel I'm going to focus on the human element and I thought the best way to do that is actually to start with you, the audience. If we think about the last week or fortnight it's been an interesting couple of weeks - and I'm not actually talking about South Australia, as you in the energy field would probably think. I'm talking about last weekend.

Put your hand up if you watched the AFL historic Grand Final. Put your hand up if you watched both, some people are admitting. What about if you just watched the rugby on the Sunday? Okay, we're starting to get a feel for this audience. What about if you didn't watch it at all and did something far more interesting because you couldn't give a rats about that? Okay. Panellists, did we get a feel? Okay, I've got some other questions here. You actually referred to energy expertise, put your hand up if you would classify yourself as an energy expert. So not everybody in the room, but some. As an energy expert, do you study your electricity bill every time; do you know how much petrol you put in? I think there are some really interesting things to think about behaviours and who we are. The other thing that I was going to think about also is solar, because often this discussion comes up between the renewables versus solar and so forth. Who has solar panels on their roof? Some, not all. Who actually didn't take the RECs (Renewable Energy Certificates) to offset and kept it because they were being really good carbon souls? Not many; a lot of people probably don't understand the RECs in that way. And a subscription to green power, who subscribes to green power a little bit, 100%? Probably about 3% of Australians subscribe to 100% green power.

The reason I did that is to think about who is there and what's driving our values, beliefs and behaviours, and I'm sure if I asked those same questions in Melbourne, Sydney or Perth we'd have similar numbers, maybe different geographic nuances, I'm talking about AFL and rugby. If we even probably went to Germany or to the USA, change the sports and we might get similar. But if we move those questions to places like Sub-Saharan Africa or to developing Asia, most of those people if you ask them that sort of question would probably be fortunate if they even had a television to actually watch. So that's what I want to think about here is this whole issue. If we take the 2015 World Energy Outlook it estimated, as many of you know, 1.2 billion people, that's 17% of our global population, did not have access to electricity in 2013 and many more have very poor supply. My dear friend here, Chris Greg from the UQ Energy Initiative, just recently put this in perspective. When we're talking about energy access this is the most basic level, and his example was two lights and some mobile phone charging. So we can think about the football, but imagine thinking about you're actually privileged if you have access to two lights and some mobile phone charging, not to mention the 2.7 billion people that are still relying on traditional solid biomass for cooking and all of the associated health impacts.

So I think one of the things that all of you know is energy is central to so much in our world today, whether it's jobs, education, security. There is so much about energy that's important and from my perspective, having watched this debate as a social scientist, when we think about fossil fuel energy, which is deemed relatively affordable compared to the price of other energy technologies at the moment, to actually contemplate a world where demand for coal, oil and gas isn't there I actually think is quite tricky and why this issue I think is so contested, particularly if we bring it back to Australia. Not only does it underpin a huge component of our energy right now, but it's also one of our largest export dollar earners and you can only think about how we benefit from those. But that's not to say that

things aren't changing and we know there are a whole lot of technologies, be it battery storage, electric vehicles, the rise of the internet and smart appliances, things are changing, but I think the question here is to think about what is the way forward and how can we do that, and let's not forget those people without access. The other thing that really is of most concern to me, in addition to this issue of energy access, and it's actually why I got involved in energy in the first place, is the lack of leadership, both here in Australia but also internationally, if we really want to get to these Paris targets. I don't really see it, the need here for bipartisan, tripartisan support; ideally energy should not be a political issue except through leadership in making a difference, and actually if we pause and think, China's probably one where we are seeing leadership, they've exceeded their 2020 targets for wind and for nuclear, far exceeded it in 2016.

So one of the things that I think we will need is a meaningful price on carbon, and I won't go into detail about that, but I actually think that that will give an imprimatur to the fossil fuels to start changing some of their things and moving down the path that some have started to. From my point of view, to be successful one of the critical things with that if we do is communication: how do we make sure the public understand because, quite frankly, energy affordability is critical for Australia, but it's also critical across the world. We had a webinar last night from somebody in Germany talking about the energy transition and one of the biggest issues right now for that country is that prices are going up and the political party is concerned about whether they're going to get voted back in so, again, politics is there. And that's my time and some.

KAREN HUSSEY: Mick.

MICK BUFFIER: Thanks Karen and thank you for the opportunity to come along to talk tonight and the invitation to be here. I'd like to cover off on four areas fairly quickly, talk about the global outlook, global macroeconomic factors; talk about the role of coal and gas; talk a little bit about INDCs and COP 21; and then finish off on low carbon solutions for both coal and gas.

Let's talk about some of the global macroeconomic drives that are going to affect us over the next 25 years out to 2040. The first thing is population. The global population is going to grow by about 2 billion from around 7.3 billion to 9.12 billion in 2040. The next thing is in terms of economic growth, and a lot of the information I'm using is also from the IEA. Economic growth is projected to be around 3.4%, 3.5% out to 2040, but it's skewed very heavily to the non-OECD world. OECD countries, like Australia, Japan, the UK and the US, are going to grow around about 1.9%, so that's slower growth, but if you look at Asia we're talking about 5.5% growth. Before I go to urbanisation I'll come back to a point that Peta touched on. So 1.7 billion people in the world don't have access to electricity, but there are 2.8 billion people that don't cook with electricity or gas and I wonder how many people in this room do, I doubt whether there'll be anyone. But think about that, two out of five people in the world still cook without electricity or gas, 800 million in India alone and in a lot of other countries in Asia. So they have this lack of access to the type of world that we have. If we talk about urbanisation, urbanisation in OECD countries, including Australia, Japan, the countries I mentioned before, is around 80%. So think about Queensland, you've got Brisbane, the Gold Coast, Rockhampton, Mackay, Cairns and Toowoomba. In the Asian world the average is 47%, but if you go to a country like India or Myanmar or Vietnam it's 33% of people, which means two-thirds live in rural areas and most of those people who live in rural areas have the cooking facilities I described.

So for economic growth and a better quality of life we're going to need reliable, safe and affordable energy sources not just for electricity, but essential services and industry and that development. So let's talk about what both coal and gas are used for. Well, most people would understand that they're used to make electricity. So today in the world 41% of the world's electricity comes from coal-fired generation and 22% from gas, 16% from hydro, 11% from nuclear, and non-hydro renewables today are 4% of the world's electricity generation. But coal has other important purposes. So 70% of the world's steel is made using coal and it's been that way for 2,000 years. The other important ingredient that it makes a large contribution to, in fact 90%, is cement. So when you think about urbanisation in developing Asia, they need those for the necessary infrastructure to do with roads, railway lines, buildings, schools, hospitals and airports. Let's just talk quickly about gas and even thinking about your own home, I would suggest to you the only thing in your own home that's not made with the use of coal or gas are the organic products such as wood or wool carpet. Everything else is probably mined and has used some form of heat source to make that product. Glass, the heat product there is gas. Gyprock is also gas. Think of all your tiles, bricks; you need gas and, of course, we need it for cooking and heating as well, as we need electricity.

So just to reinforce that, we mentioned the Rugby League Grand Final last Sunday and I would like to ask how many of you understand how much of your electricity at that time was coming from coal and gas? Would you be surprised if I told you it was 98%? And anyone who wants those figures, I can give them to you, it was 89% coal-fired generation and the other 9% came from gas. Now in Australia typically, particularly the eastern seaboard, quite commonly 85% of our electricity is coming from coal-fired generation so it's going to be a big step as we change the energy mix. So think about Asia. India is going to grow its electricity generation by 3.5 times between now and 2040. Coal will be an important part of that, it's going to increase 2.5 times, but renewables are projected to increase at least 10 times. The International Energy Agent says that in Southeast Asia, again, coal will be 50% of the generation mix in Southeast Asia by 2040. Let's talk about energy as a whole and I'll move onto the IA very quickly, but in terms of energy in the world today, every time you hop in a car or fly in a plane you use oil, but today oil, gas and coal make up 81% of the world's primary energy. Even with the INDCs and the COP 21, that's projected to fall to 75% but to do that we'll have to spend $13.2 trillion to achieve those goals.

Now, if we want to drop down further we're going to have to spend an enormous amount more, in actual fact to do it the IA is saying you need a carbon price of $100 a ton in 2030 and $140 in OECD countries by 2040, and even after that those three sources of energy will only drop down to 60%. So it's not easy and I think some of the happenings in South Australia last week illustrate that. But the really important message I want to leave you with is there are low carbon solutions for oil but particularly coal and gas. For coal and gas-fired power stations yes, gas does give off CO_2, about half as much as coal, probably more if you take into account fugitive emission, but the opportunity is with high efficiency/low emission power stations where you can reduce the CO_2 emissions by 35%. If you go to carbon capture and storage (CCS) you can reduce them by 90%. Yes, that will cost, but all forms of energy will cost. So to conclude, we are going to need a balance between economic drivers, social needs and meeting our climate change and environmental goals. I'll leave it at that for the moment.

KAREN HUSSEY: Take us home David.

DAVID BLOWER: Alright, I'll try and keep this reasonably brief and, despite being nicely setup by Sandra to talk about policy, I'm going to actually talk about what COP 21 actually means for the demand for coal and gas. If we leave aside the INDCs and the commitments that were made until 2030 we've got to remember that the overarching ambition of the COP 21 was that we would limit the emissions in our atmosphere to limit warming to well below 2° from pre-industrial levels and with a very strong aspiration of 1.5°.

What does 2° below pre-industrial levels mean for coal and gas? Well, for coal you see coal demand peaking sometime later this decade and then start falling off by about 33% to 2040, and even in 2040 coal only exists because it has CCS. For gas you see it peaking in the mid-2025s and then flat lining, and even then it's still all around having some CCS to be able to do that. If we take that 2° let's just look at what the 2° means for people. A general rule of thumb means that for developed countries like Australia you have to get to net zero emissions by about 2050. For developing countries that's sometime later this century. So that means we cannot produce, we have to have net zero emissions in 2050. This means the way that we currently burn coal and currently burn gas cannot be done if you are going to meet your international climate change objectives. I'll put that as "if you're going to meet those objectives". I understand the challenges that have been made by Peta in terms of access, the challenges that have been raised as well in terms of the fact that we are highly reliant on coal at the moment, and those issues around steel and cement are really tricky. The steel and cement issues are ones where we're probably going to end up having to look for offsets because we don't know how to do it differently, but the bottom line is that coal and gas have a limited future in a world where you actually are aiming to limit the warming of the planet to within 2° of pre-industrial levels without CCS.

So because I'm going to keep this short I'm just going to quickly talk about CCS. Currently CCS is a fairly expensive technology that is being used. If you compare it across the range, CCS with coal is not even close to being there. CCS with gas you might get away with, CCS with gas looks okay, it looks comparable with some other technologies, but even then onshore wind, even nuclear look like they are going to be better bets than CCS. Let me give you an example, the IEA projections, they actually did the projections on what a 2° would look like and it calculated that by 2050 CCS would have to contribute to 60,000 million tons of abatement a year. Last year the combined CCS projects in the world delivered 28 million tons of abatement. That gives you some idea of where CCS is going and, by the way, as a country that exports a lot of coal and gas you'd think that Australia would be really keen on CCS. Back in the 2014 Budget the funding for CCS was absolutely slashed post-2017. We are not putting the money into it, the R&D is not there and at the moment it doesn't look cost effective, and unless CCS comes on board there is very limited future for coal and gas going into the long term. Thank you.

KAREN HUSSEY: Thank you very much indeed David. I might kick off first with a question for Sandra. I've read your report, to the extent that one can when it was released yesterday. First of all, congratulations on a report that actually takes an analysis across the whole supply chain to identify where climate risks are and who's really, really vulnerable. I was interested in the fact that the push for that is coming from investors, but I wonder what the level of awareness is from those that are high risk? In fact, you call it an "existential risk", those that have a high level of exposure in a climate constrained world, to what extent do you think there's a level of awareness that the end is near if we're to meet our Paris commitment?

SANDRA MCCULLAGH: I think some of the sectors are very well engaged in this. I used to be the Utilities and Oil & Gas Analyst before I took on Environmental Social & Governance, so it's kind of my background. I can tell you some of Australia's utilities have worked out that they need to engage actively on policy. So you look for what's their disclosure like and actually we hand out bouquets and brickbats. We gave a bouquet to AGL for at least in their sustainability report released a couple of months ago actually doing a proper 2° scenario and showing that loss of 25% of value on their generation assets. So you will find some companies doing it well. They are actively engaged now under a new CEO with the government in how do we have an orderly closure of coal plants, particularly because they own the biggest, one of the most polluting brown coal plants in Victoria. So they're very actively engaged and they originally came from a position of, "Our plant's the youngest so everyone else will have to close before us and we'll get all the upside". They've realised that's not politically palatable and so they're looking for great solutions.

So I have great hope for the utility sector. Some other sectors I feel are still in denial and not seeing the risks and perhaps are not prepared for them. We wrote a paper earlier this year on stranded gas assets and I understand we're the first to look at the stranding of deep water offshore gas. It astounds me that companies will still pay big money to buy something 600km offshore from WA in the expectation that perhaps in 10 or 20 years' time they might be able to get up an LNG project. They're still paying big money, so that's where I see big investor risk.

KAREN HUSSEY: Mick, I might pick up on that with you in terms of the picture you painted was of a world that faces enormous challenges in the coming decades and, if I understood you correctly, there's still in your mind a very, very strong role for coal and gas, but certainly still coal, which contrasts quite starkly with David's presentation. I wonder how do you anticipate us meeting our Paris Agreement? What kind of policies would you like to see in Australia that would see us avoid the worst of climate change and at the very least stay below 2° if not maintain at 1.5°?

MICK BUFFIER: If I give you a good example, and I gave you the high percentages in Australia, particularly the eastern seaboard. The percentages are high in Western Australia because they use both coal and gas and quite often they're over 90%. The technologies that I mentioned to you apply here in Australia as well, so if we take ultra-supercritical power plants that Japan and China have been building, which not only reduce CO_2 emission by 35%, socks, knocks and particulate matter by two-thirds, we don't have one ultra-supercritical power plant in Australia. We only have four supercritical power plants which are not quite as effective and the rest are subcritical.

So the challenge for Australia is I think in balancing both the cost and the climate change goals for our energy supply and our electricity going forward. I mean, people would have seen the situation in South Australia and, of course, the interconnector dropped out and where does it get its power from? Mostly the brown coal generated electricity, so here's a dilemma. So to me, firstly, you have to have a stable and reliable and affordable grid. People in Australia need to be able to afford to pay for their electricity. There are solutions for coal and gas and those solutions include those technologies here, but once you start going to very high levels of renewables you have unstable grids, so you're going to need a secure backup and that secure backup in Australia has to come from coal, gas, hydro or nuclear. If I take Japan, and their INDC is a good example, their electricity mix in 2030 will be made up of 25% gas, 25% coal, 25% nuclear and 25% renewables; 50% is non-carbon. That's how they're addressing it. I'm not advocating that's the exact answer for Australia, but this has to be looked at very closely because, as the Prime Minister said last week, energy security is very important.

KAREN HUSSEY: Do you want to respond to that David?

DAVID BLOWER: I guess the first thing in terms of building in supercritical coal generation, we're kind of starting to reach a tipping point in terms of investment in generation if you believe in the fact that the 2° scenario is going to be met. So if I was going to build a new coal-fired power plant now the maximum life I can get out of that power plant without CCS is going to be something in the realms of 30 years and, given the expense, can we expect prices to be at the stage particularly if we get any form of carbon pricing on that? I kind of see it as a little bit unlikely. I see gas playing a role in electricity generation going forward because one of the things about having higher penetration of renewables, particularly intermittent generation, is you need flexible generation to be able to respond. That is gas, that's not coal.

So gas could very well play a role in the short term but, again, the same thing holds: you either want us to hit the 2° target or you accept that we're not going to. So if you want to hit the 2° target any investment you make in these plants, you've got to understand that investment ends in 2050 and if we actually keep going on the trajectory we're currently at, that 2030 target, you don't actually hit 2°, you hit somewhere close to about 3°. And those targets are going to change in five years, and the target for Japan is going to change in five years, because everyone's got to come back to the table and re-submit it. This is not saying that coal will not play a part or gas will not play a part, this is the reality of climate change. This is what you've got to do to be able to hit it. Now, you either choose to hit it, in which case we have to start planning for a future where we don't have coal and gas, or we choose not to hit it, in which case we decide that yes, we want energy security and affordability and all those other things as well, but if you start prioritising that over climate change you accept that you're not going to hit the 2° target and you accept the risks that come with that. That's the choice that is faced.

KAREN HUSSEY: Can I just ask, do you think people are making that choice in what you're seeing today? I'm interested in that because that's what worries me.

DAVID BLOWER: I don't think we'll hit 2°. My personal view is that we are still going too slow now. I think that your point that you made at the beginning of this conversation about how long this has been around. In 1990, when they first came up with the 2°, climate scientists thought it was a very conservative estimate because surely the world would act by now to actually be able to hit that? And now we're in real danger of not hitting 2°. Basically if we just stick to those INDCs that we've got going until 2030, the world falls off a cliff sometime in the mid-2030s. You have to stop polluting at that point. You are going to have to do an awful lot very quickly and there's just not the action there to be able to do it.

SANDRA MCCULLAGH: Yes David. In April I chaired a session on this particular issue in Hong Kong and one of the speakers was the Environment Minister for Hong Kong. So I asked her about what is it with coal and China and are they going to continue to build these ultra-supercritical coal plants or supercritical coal plants? The response was China will continue to build these and at some point they will then just decide that they're not going to build them and suddenly - and we had through this conference used the term "zombie state organisations" - there will be a massive pile of stranded assets, but China doesn't care; they will just turn the switch. We don't work like that in Australia. To get an ultra-supercritical coal plant up you need stability of policy and investment, and 30 years, yes David, doesn't cut it. You cannot make an economic case to build ultra-supercritical for 30 years. AGL

is closing plant after 63 years, that's kind of the investment case and if you bring that MPV back to 30 years it doesn't stack up.

MICK BUFFIER: Can I respond to that? China is leading the world in ultra-supercritical power plants. Australia does not have one, so I don't know how you can criticise China. If you look at the INDCs that were submitted into COP 21, 19 countries submitted coal as part of their INDC. China committed to reducing the emissions from its coal-fired power plants, it committed to also reducing or curtailing or capping coal, but I was there in May and it's extraordinary the commitment they have in their five year plan, which is in their INDC, to both knock down old coal-fired power plants and rebuild them with these ultra-modern ones that put out less emissions than any standard in Europe or the US or Australia. So there is a solution, it costs. Getting to 2° costs and people must realise that, but if you look at Australia, we produce 6% of the world's coal. We are the largest exporter of coal, about 32% of the world's coal, but we only produce 6% of the world's coal, but we can play a valuable role in finding solutions. Unfortunately our agenda has dropped off on things like CCS, but the world really needs to have a look at that. Don't forget, in the last ten years $2 trillion has been spent on other technologies, including renewables, 1% of that on CCS. We can get to 2°. We need technological solutions, but it will cost, everything costs. The answer is in technology and don't forget CCS captures 90% of that CO_2, but it also provides an opportunity for net negative emissions if you combine that with using biomass at the same time.

KAREN HUSSEY: On that note I might throw it out to you, dear closed public.

AUDIENCE: Mick, you're peddling a product that's threatening the biosphere. How do you sleep at night?

MICK BUFFIER: I have no trouble sleeping at night. I'm an engineer, I'm a practical person and I look towards solutions. Let's talk about some realities. What does coal provide? It provides necessary electricity, necessary steel, necessary cement to people here in Australia where we enjoy a very high standard of living. You can't do without those products. That's the problem we have, it is quite polarised and people are not rational in this debate about the needs of the world for energy. You cannot lift people out of poverty, all those people in Asia. In Myanmar the greatest source of heating and warmth and that is actually wood, in India it's wood and cow dung; so 800 million people don't have it. We enjoy that. Here we are, sitting in Australia and we're using very high percentages of coal and gas-fired generation. I do believe we'll reduce that and there is a way of reducing it, but there comes a point in time where if you don't have a stable reliable supply you're going to have problems with your energy supply, as we saw in South Australia last week.

So you've got to get balances between economic, social and environmental aspirations. Sustainable Development Goals of the UN, the first one is no poverty, number seven is affordable and clean electricity, and number eight is having decent jobs and economic growth.

AUDIENCE: The comment that I'd make is that here in Queensland at the start of the real debate on climate change in the early 2000s the Labor Government under Beattie brought in a compulsory gas energy scheme to try to get Queensland down from 99% coal-fired generation. Within five years he reduced the total footprint of electricity generation in a hugely growing Queensland market by 10%. New South Wales did much the same with a slightly different scheme, but during that time the issue of the industry doing something about it has been overtaken by schoolyard debates about utopia, which

we just heard from the Grattan Institute isn't going to happen because, one, China's not going to be involved anyway and neither is India. So it's a great aim to get there, but all of the effort that people in the industry, like Mick is, is there every day trying to find solutions. We had solutions at that time and we were doing it and what happened? As a result of the utopia and a Prime Minister being elected to solve the greatest problem of the world, which wasn't how we get there but it was a solution which has turned out to be what's happened in South Australia. He brought in a carbon tax, a carbon tax which reduced gas-fired generation and increased electricity prices and that. So it's not a matter of someone having a go at Mick and saying his answer to the question he's a pig. He's there contributing to the debate. It's how we get there. It's not whether or not we have to be somewhere by 2050, it's how we do it today and tomorrow to keep the lights on as well.

AUDIENCE: Peta and Mick, to the human commentary that you make, the argument we often here is that development depends on power and power for development depends on coal. I feel that we're having this conversation in absence of any understanding that the people most impacted by climate change if it happens will also be the poorest. I would love to hear from you on that part back on this question of are we actually going to do 2° or are we not and are we thinking about those people's energy access in absence of the impact of climate change?

PETA ASHWORTH: I don't think so. I think that's part of the issue and I really don't know what the solution is. Just last week we had someone over from Indonesia and they've got 17,000 islands to try and provide energy to. There are lots of innovations going forward but, at the same time, we need to find the most affordable ways to get them access, and that's what I'm constantly challenged by as to how we do it because I don't see that. There is innovation and there are people trying, but even the small access lights, they are very expensive programs and, as you say, people are living in poverty, how do we lift them out? That's the biggest conundrum and I don't know what the answer is. We are transitioning away, I don't think we're transitioning fast enough, but I think as part of that we need to make sure that those people are exposed to the same rights of development that we have in the developed world, and that to me is the challenge. I don't know what the answer is and I'm concerned about climate change. I mean, one of the things I've said for many years is climate refugees. We're not prepared for that and I think Syria's a fantastic example.

These are the things that keep me awake at night when I think about this and it's why I'm so keen to try and get these discussions happening. We've got to move outside the converted energy experts to people in the lay public, to the broader world. So it's very complex and very challenging and we need the advocates for climate change to start communicating as well, but it's not an easy answer.

AUDIENCE: I just wanted to raise an issue for your discussion around the fact that we're often talking about developing countries here. These places were subject to colonisation where a bunch of Europeans with business interests and some ideological agendas showed up and said, "We know what you need, you need civilisation, you need Western guidance for proper development".

That happened several hundred years ago and many millions of people lost their lives through the colonisation process and now today we have people standing up saying, "All you people in those poor countries, we know what you need. I work for a mining company, I think you need coal" totally ignoring the fact that we've got people like multiple Nobel Prize winners in the African continent saying that climate change is an extreme threat to people in Sub-Saharan Africa. You had Nelson Mandela, Wangari Maathai, J M Coetzee. The President of Uganda, Yoweri Museveni, said, "Climate

change is an act of aggression by the developed world against the developing nations". I'd really like to request that you have the respect not to speak on behalf of those people who are worst impacted by climate change in selling your products and marketing on behalf of the companies that you work for. Please have that respect.

KAREN HUSSEY: Does anyone want to comment on that?

MICK BUFFIER: I'll just quickly respond to that. It's actually the governments in those countries that are making the decisions. So in India, Prime Minister Modhi said he's going to give his people access to electricity 24/7 by 2022. The reality is one company in India produces more coal than Australia in total and the government there, it's essentially government owned, is going to go from 500 or 600 million tons to 1 billion tons, and still then all their people probably won't have that access. But, at the same time, he's committed to large amounts of renewables. I mean, the rate of increase in renewables there is going to be many times what it is for our traditional coal-fired generation or gas-fired generation. The other example is Indonesia, a very large country. It's bringing on 35GW of electricity generation. Two-thirds of that is coal because they're endowed with that, but they're also bringing on renewables but it's just so difficult. They're decisions that they're making as governments, as countries, not anyone externally forcing that upon them.

AUDIENCE: Australia is a major exporter of coal. It's not the largest producer, but it's I believe the largest exporter of coal and Queensland is the largest state exporter. We also produce enormous amounts of aluminium. My question is who is ultimately legally and morally responsible for the emissions associated? Is it the country and the company that exports the coal and aluminium and other energy-intensive products, or is it the end user that ultimately carries the moral and legal responsibility for the emissions associated with that?

DAVID BLOWER: I'm not aware that there's any legal responsibility for anyone in terms of greenhouse gas emissions, as far as I'm aware, I don't know any different. In terms of moral, this is a pretty good question.

I think morally we need to sit back and actually think about why have we done this stuff, why have we emitted over the lifetime? I think some of the points that Mick has raised have been good, coal has been really good for us, it pushed us from the 17th century into the 20th century, it was responsible for a large amount of economic development that we had. We have really benefited as a society from this. The bottom line is we have to stop using it, but we have all benefited from this. When we buy our clothes we have benefited from this, when we purchase anything we benefit from the fact that these things have been emitted. When people ask me on a local level, "What can I do about climate change?" Well, at the moment if you want to do something, stop consuming stuff. If you stopped consuming stuff you will reduce your carbon footprint, you will help emissions. I'm not advocating that that's what you should do, but on a personal level that's what you can do. We have all been sat here consuming stuff that is emitted. We can sit there and blame the companies that have built it and try and sell it too much, but at the end of the day they've done that because we've demanded it, because we have accepted it, because we wanted the cheap products, because we wanted those things.

So to a certain extent there is a moral responsibility that sits on everyone because we are the ones that have done that. Okay, maybe we didn't know the extent to which those emissions were going to

affect us, but we do now. To an extent, those businesses didn't know either back in the 18th century when they first discovered the Industrial Revolution.

MICK BUFFIER: I think where Australia can help those developing countries and the developed world is it's inevitable that they will use a considerable component of coal and gas-fired generation, they'll use it for other reasons that I mentioned. The solution is around technology and the developed world has the resources. We talked about CCS, it's the developed world that can lead in that, not India and not Indonesia, and that's where we in Australia, as a large exporter, can play an important role. There is already bilateral and tripartite work going on even between China and Australia, Australia and India. So that's a really important thing that we can do. I mean, I know people would like not to be able to use it but, in my view, to try and balance up those aspects I said fossil fuels - and don't forget about oil for your own transport, for aviation, for shipping - will continue to be used, but we have to find solutions if we are going to get a climate change solution.

SANDRA MCCULLAGH: David, I know one of our major listed companies has done a 2° scenario for its business and, lo and behold, it finds that its business is entirely unaffected by a 2° scenario despite having coal and petroleum in its business mix, because its 2° scenario when you read the fine print relies entirely on CCS. I know investors are particularly worried about that because it indicates to you a company that's perhaps in denial and is not looking at, as you would expect a board to, a variety of options and realising that you can't put all your eggs in one basket of carbon capture and storage.

AUDIENCE: I suspect that what we're seeing here is a failure in policy. We've heard very eloquently from David that we have to reduce fossil fuel use in order to achieve 1.5° or 2°. We've heard from Mick that this isn't going to happen because it's all terribly difficult and we're well-established on that road. We've heard from Sandra that companies are now starting to think about this is in a very proactive sense and so the wheels of capitalism are now moving. The question is what is the policy push which makes Australia do something that brings all of this together to actually get somewhere, instead of just continuing to talk about it, as we have for the last 15 years?

KAREN HUSSEY: Great question.

DAVID BLOWER: In terms of the policy I think that there is still a bit of a way to go. We released a report earlier this year that looked at how both political parties can take this forward in a bipartisan way, but it's not clear that that bipartisanship actually exists yet. There is a pathway through it, there are potential schemes which could come about where we could end up getting that, but a lot will rest on the 2017 review that will happen next year and a lot will be highly dependent on what happens on, firstly, both sides, the Coalition Party and also within Labor as well and to more extent whatever happens with the crossbenchers. But there are reasons to be kind of hopeful. I think the first thing is, as Sandra pointed out, businesses are now taking this seriously. That provides a significant push to government to actually find a deal if people are turning around and going, "You have to come up with something sensible and we want something sensible and we want it to stay" and finally we're starting to get that message. I mean, just yesterday you saw a number of peak bodies come out and basically ask the government and the states to be consistent on their climate change policy and it's really important that they do. So there's that firstly as a push.

Secondly, the current political situation and the review and the fact that there will be a review of the Paris targets in 2020 also push the government to do something. At the moment its policies are not

going to reach its 2030 target, it's just not in place. It is going to have to put something else in place and something else may well need Labor support if they're going to get it through parliament. So the very nature of the parliament at the moment makes it happen. The third factor is just international pressure. I know from speaking to people, generally Australia is not viewed very well internationally when it comes to talking about climate change. When they talk about it behind closed doors, Australia is being treated a little bit as a pariah basically because we had what they saw was a good system and then we got rid of it. So that international pressure for Australia to actually go and do something will be another factor to get some decent policy in this space.

KAREN HUSSEY: Not just climate change sadly. Sandra?

SANDRA MCCULLAGH: Yes, business is demanding that policy certainty and consistency. We had a visiting professor out here recently, and it's nice to get the European perspective. When we informed him that one of our largest carbon polluters in Australia was planning to close its brown coal power plant in 2048 he fell off his chair laughing. One possible solution to this politicisation of carbon, because business does want certainty, is to come up with an independent regulator for this, take it out of the political sphere and give us that 10, 20, 30 year consistency. We regulate our financial institutions this way, we have APRA. We need the APRA of climate change and take it away from politicians. We cannot afford to have three years of flip-flopping policy, that's just not sustainable. We're going to get nothing done and nothing built.

KAREN HUSSEY: But in order to get that independent authority you're going to need the politicians to agree to it and they're presumably doing what the public wants them to do or what they think the public so Peta, the public's behind this ultimately presumably?

PETA ASHWORTH: Absolutely, the majority of Australians are concerned about climate change, if they could they would have renewables tomorrow, but as we see there's this issue of paying for it. So I think something like that is an important step, but we need to make sure we can bring the public along, I suppose, because from my research looking at national surveys you get this bell curve of people that are really proactive, the sort of early adopters, and they're doing great stuff. Then you've got all the people in the middle that are concerned, but they're busy, they're trying to feed their children, they're trying to get to work and just pay the bills and they don't have time to interact. So we've got to make it easy, but we've got to find a way to build people's literacy around this issue.

KAREN HUSSEY: Peta, to what extent are we seeing the public identify bushfires, floods and events like last week as being something that's going to happen more often and worse?

PETA ASHWORTH: There have been lots of studies done of this. Immediately after a severe weather impact, and we had it here in Queensland, people's concern goes up but what happens, and I think it happens in our private lives as well about other issues, is after a year or two goes on you start to fall back into your lazy ways. I mean, the classic was when petrol prices went up and all of a sudden there were more small cars being bought, people were catching public transport and Melbourne was losing money on their parking fees, but then roll on three years and suddenly that's become normalised and we all resume the behaviour.

KAREN HUSSEY: The same is true of drought until it rains.

PETA ASHWORTH: Yes, absolutely.

MICK BUFFIER: Look, we do need a very clear energy policy in Australia, I think we need that to have secure, affordable, reliable energy here in Australia. It doesn't matter whether you're a renewables company or whether you're a generator, and you can either be in gas or hydro or coal, you need clarity otherwise one of the problems we will end up with is not having secure electricity and secure power. To give you an example, two things about the South Australian issue, there have been three big outages this year, is the price there just skyrocketed. It went from $100/MWh to thousands.

PETA ASHWORTH: That's been happening for years and years and years Mick, that's how the market was designed.

MICK BUFFIER: Not to that extent, that is not right.

PETA ASHWORTH: That's true, in 2007/8 we had these repeated high price events in South Australia. It had nothing to do with renewables.

DAVID BLOWER: Higher spikes in 2013.

MICK BUFFIER: The other thing we had was a cyclone in Queensland with 200Km/h+ winds and we didn't have the state fall over in its energy supply, but in South Australia they were less than 100Km/h. This is important, it's important for everyone to get that right.

AUDIENCE: You talk about the importance of continuity of supply and that's clear, but you also talk about innovation and technology as perhaps being part of the solution. I wonder what your opinion is on these companies now that are producing storage batteries for solar based on zinc bromide and that sort of thing, could this be part of the solution, storage batteries that work with solar that will store the power when there's no sun and wind?

MICK BUFFIER: I think the answer to that is that there is no doubt at some point in time in the future battery storage will be a very important part of the solution to grid stability. At the moment the quote I've heard is that if you put all the batteries in the world together you could run the world's supply for nine seconds. That's not to belittle the fact that I think the first thing you'll see battery storage coming into is particularly households, but to keep a major city going that technology is not here. It looks as though it's still decades away –

PETA ASHWORTH: And so is CCS.

MICK BUFFIER: No, actually that's not correct, CCS is happening now. In Norway they've been storing CO_2 out under the North Sea from an LNG project for 20 years. It's the affordability of it and if you want to bring the cost down you've got invest. So it is possible, there's a coal-fired power plant, the Saskatchewan Power Plant, in Canada that's running, there are about 20 in the world. It's not moving as fast as what it needs to if it's going to be part of the solution, and the reality is if we want to get to 2° or lower it has to be part of the solution.

KAREN HUSSEY: I'm going to take two more questions, but in the meantime panellists we'll then close with the one final thought you'd like to leave with our audience.

AUDIENCE: My question is in the context where we've got coal companies like Peabody, pure play coal companies going bankrupt. Is the market going to take care of it before governments catch up basically? Are we seeing money, are we seeing companies move in the right direction faster than governments because of the influence of associations like the Minerals Council, like the Queensland Resources Council that are holding back our policy development at a federal and a state level?

MICK BUFFIER: If we take Peabody, they are in Chapter 11 but they will come out of it. I just saw something interesting in the US today and right today in the US gas is doing more generation that coal, but only just slightly more. So in the US at the moment 31% of the generation is coming from gas, 29% or 30% from coal, nuclear is next and renewables are less than 10%. That's the US. Now, I think all coal companies do is respond to a need for supply. I tried to make the case earlier that the oil, gas and coal are going to continue to be required for years to come for the necessary need of reliable and affordable energy. We've seen the UK commit to a nuclear power station.

AUDIENCE: Sorry, I'm just going to jump in, that's not actually answering my question. I was talking about whether we're seeing both companies and money flow away from dirty industries because traditional historic industries, like the coal and gas industries, have been holding back policy development, and I think the current energy mix doesn't really answer that question.

SANDRA MCCULLAGH: I think I'll jump in with an answer. Our concern is that as coal volumes fall away, and we're seeing India and China ramp up their own volumes so we're looking at the Australian companies, if demand is falling by 10% or 20% or 30% it's not rational in that it says, "Okay, demand has fallen 10%, we're going to shut down one in ten mines". Everyone's volume is ramping down and their costs are staying high, and that's what's going to drive investor concerns; that these companies will not be viable as demand starts to fall away. So that's where rationalisation of the capital markets will happen. It won't be, "Oh, let's just shut one in ten and then one in five coal mines". Everyone's going to be affected across the board and that's going to affect their cost base, their revenue base, they're going to become less profitable and it's going to impact on their share price.

MICK BUFFIER: So to give you a slightly different view, volumes in Australia of coal have continued to go up. Volumes have not dropped off. From 2007 to now, 2016, coal volumes are up about 60%, iron ore values are up more than double. The price has dropped and, like all commodities, prices drop particularly with slower growth out of China and the rest of the world, but volumes have not dropped off. The other important thing is coal in 2005 was the largest revenue earner for Australia, about $17 billion. Today it's $38 billion. Iron ore is $55 billion and gas is number four at around $17 billion. So they're making a major contribution to Australia's economy and volumes are not dropping off. Sure, when prices come down companies have to adjust, but that's the same for every cyclical downturn.

AUDIENCE: In regards to energy security, wasn't it Vesey from AGL that recently said if your key driver is energy security you should be looking at renewables rather than fossil fuels?

DAVID BLOWER: Well, I haven't seen that. I have seen people before suggest that renewables would bring more in terms of energy security. Look, I think over the past two, three months with the situation in South Australia people have become a little bit panicked about what's going on. I think people need to calm down a little bit in terms of what's happening. Yes, we saw very high prices and, as we've said, those very high prices have been seen before. The issue there was actually about hedging and

hedging contracts' availability to businesses, and there's a question there about the availability of those hedging contracts and whether they're there for big businesses or not and really that caused that outset. And what happened last week was there was a big storm, it was a really big storm, and whilst the energy market operator hasn't been able to be definitive, I think everyone should wait until the three months is up and they can actually be definitive about the course of events and why these things happened, and the end result could be that it was just a very big storm.

So in terms of energy security, there are lots of things that can be done. Yes, renewables can play a part in that. Yes, introducing different markets can be a part of that. Yes, making sure that your network is correct can be a part of that. But I think that the biggest thing that everyone needs to do is actually just take a step back and just think about what the real issues are here and work through it methodically and make sure that we get the right electricity system for the future. Let's not jump to any conclusions.

KAREN HUSSEY: Thank you. So a 30 second nugget of wisdom from our esteemed panel please, starting with Sandra, before we thank them riotously.

SANDRA MCCULLAGH: One other thing I look at is governance and how people react and I get nervous when I meet with companies that are in denial or people who are in denial.

PETA ASHWORTH: For me, I think the thing that I like to think of is it's a portfolio of options and we've got to keep our minds open to what the end solution will be, and it's not going to be a one size fits all. From that point of view, keeping aside vested interests and trying to be open-minded about what that portfolio might be because we really need all our cards on the table right now in the way that the world is going, let alone Australia.

MICK BUFFIER: I'd invite anyone in the audience to go to the World Coal Association. If you think we're in denial go and have a look at that and have a look at the solutions that are there in relation to this issue around climate change. As I said earlier, it's not an easy fix. There's no silver bullet and there's no one-dimensional solution, particularly when you've got the competing needs of providing affordable, reliable energy to the world. So that's both the economic aspect and the social needs, and then combining that with finding a solution to environmental aspects, and climate change is just one of those environmental challenges. It's a very important one, it's in the minds of everyone, but you need a balanced solution.

DAVID BLOWER: I'm going to change tack slightly. I did very quick maths in my head and, from Mick's numbers, coal and gas contribute $55 billion in revenue to Australia. That industry also supports an awful lot of jobs and, from what I said before, all of that's going to go by 2050. Now if this was a business working properly we'd have some sort of risk management strategy or transition plan in place and at the moment the governments across Australia do not have that in place. This is really important, that issue of denial is not there. Hazelwood in Victoria looks like it might close next year, that's 1,000 people's jobs that are going to be affected. As much as we want climate change not to happen and we want to move that transition, we have to understand that people will be affected and governments need to get on it and actually put transition plans in place.

KAREN HUSSEY: My little gold nugget is that as we do that, let's not lose sight of what a world that's warmer than 2° looks like because we don't want to go there, we really don't. Alright, friends, colleagues, comrades, please join me in wild applause to thank our panel. And I say adieu.

END OF RECORDING