

Global Perspective: Implementing Carbon Pricing in a World of Political Resistance and Evolving International Participation

Chair:

Prof Mike Sandiford

Speaker:

Prof Michael Grubb

Panel:

Prof J Daley

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Transcript

Carbon pricing is the 'first among equals' in a broad triad of climate policy mechanism for cutting CO₂ emissions, but is also the most politically difficult. This talk briefly reviewed the role of carbon pricing, the debates between taxation and emissions trading as a way of achieving it, and some of the key lessons learned from the European Emissions Trading Scheme. Professor Michael Grubb is Chair of the international research organisation Climate Strategies, headquartered at Cambridge University.

Speaker: Prof Michael Grubb, Chair, Climate Strategies

Chair: Prof Mike Sandiford, Director, Melbourne Energy Institute

Panel: Prof John Daley, CEO, Grattan Institute
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AUDIO: This is a podcast from Grattan Institute, www.grattan.edu.au.

MIKE: I'd like to welcome you to the University of Melbourne to this seminar tonight which is hosted by the Grattan Institute and Melbourne Energy Institute. Before I start I'd like to pay acknowledgements to the traditional owners, the Wurundjeri tribe, and respects to the traditional owners past and present. Tonight we have a wonderful opportunity to hear from a leading voice concerned with a global issue related to a global problem, the problem of what to do with carbon. My name is Mike Sandiford and I am the Director of the Melbourne Energy Institute. My own discipline area is geology and when I start to think about global problems I like to put them into a geological context, and the problem with carbon is very easily put into a geological context. Currently we're emitting 28 billion tonnes of CO₂ each year to support our energy system. 28 billion tonnes is a big number. That's the amount of sediment which is eroded from all the mountains each year and carried by all the rivers to the sea. We're using ... making that 28 billion tonnes to deliver an energy system which is driven by digging seven billion tonnes of coal out of the ground. It's part of an energy system which allows us to consume energy at a rate of 16 terawatts, 16 billion ... 16 trillion joules per second.

We're growing that energy use at a doubling rate of 35 years so that in 50 years' time our energy use rate will be 44 trillion watts. That is the amount of energy this planet uses to make plate tectonics work, to cause continents and tectonic plates to move to cause all the earthquakes that we see, to cause all the mountains to form. So we're dealing with a global problem here. The way we're interacting with the planet is on a geological scale, and to solve our issues of how to do it we need global organisation, we need to solve it in a global fashion. So it's a great pleasure to have here tonight Michael Grubb, who's one of the leading thinkers in how to approach strategies to deal with carbon issues. Michael is Professor at Cambridge University where he is chair of Climate Strategies. He is a member of the UK Climate Change Committee that advises government on climate policy. He's a former head Chief Economist at the Carbon Trust and is head of the Energy and Environment section of Chatham House. He has a prolific publication record, including seven books and contributions to major policy pieces on mitigation in the IPCC Report. It's a great pleasure to be able to invite Michael to speak to us tonight on the challenge around a global perspective implementing a carbon pricing in a world of political resistance and evolving international participation. Thank you very much, Michael.

MICHAEL: Well, thank you very much. I'd like to thank the university and the Grattan Institute for this invitation, to all of you for coming. I hope you're feeling a little more awake than I am with, well, a touch of jetlag. This talk is to some extent to actually evolve ... following the invitation it has evolved to be a little more ambitious, perhaps, than the initial intent. I will be looking in a bit of depth about carbon pricing, drawing particularly upon the European experience, but I want to try and set that in a broader picture and almost a broader thesis of what I am beginning to think I see going on in the world's response to twin challenges of energy and climate change, and I hope it will become clear what I mean by that. Now, some of what I'll

be putting out is actually drawing upon work, trying ... I actually last published a book 10 years ago, swore I would never do it again. Unfortunately, you know, the bug eventually gets you, so I'm towards finalising something in which I have to say the first ... I approached publishers and then I sent them an outline, met them, and they looked at it. The first chapter said The Science of Climate Change, and they said, Michael, that's really boring. Can't you do something different? You can do something much more different and exciting. So I went away and came back and thought and said the first chapter is going to be called The Age of Innocence, and The Age of Innocence is basically the last quarter of a century's efforts to deal with what we now realise is one of the most fundamental, essential and politically challenging problems of this century, and the idea that it was all going to be easy. We'd do energy efficiency, we all get together, have a global agreement and, you know, and it's set in a wider context.

I then want to talk a bit more about what I now see as we move beyond The Age of Innocence, the nature of the challenge and the emer ... what I call the emerging divide, zero in on the policy triad and then look at the role of carbon pricing within that and the political dimensions in the European experience and indeed a number of the economic dimensions. I've spent much of the last two decades looking at the combination of economics and political economy on this, so I hope you're prepared for a rather broad interdisciplinary talk. I trust the political scientists at least in the audience may remember The End of History. Hands up? Okay. Good. Effectively, we entered this age in the 1980s with first what in a sense was a victory over OPEC, the group of oil exporters, and the oil price collapsed and we thought, great, and that very soon followed by and not entirely unrelated to the collapse of communism and a belief that the West, we in the West had discovered the golden keys to economic prosperity based on the belief that markets could solve all our problems, including, broadly, resource and environment problems.

Within that whole economic and political paradigm there was astonishing neglect of the emerging economies and their significance for global resources, economy, environment and geopolitics, and, looking back, I think we need to start acknowledging that this was an age that wasn't just to some extent, as we now acknowledge and discover to our great cost, built on financial debt and easy credit – and apologies to the economists in the audience, I know it's a lot more complex than that, but there is still an essential truth in that – it was also built upon a debt with relation to the way we were gobbling up the easy oil at an astonishing rate and putting the detritus from that into the atmosphere. The atmosphere is a finite system and we can measure its accumulation of our waste gases. So it's debt-based growth on both finance and energy and atmospheric capacity to absorb the wastes, and that cannot go on forever.

At the dawn of this age, in the late 1980s, we had a world that in terms of its essential distributional characteristics on carbon looked rather like this. What you have is vertically emissions per capita per different regions, and horizontally population of different regions. Obviously per capita emissions times population means the size of the blocks is proportional to the emissions in that nice, simple time in history when the world really was dominated by industrialised country emissions, a staggering gulf of north and south. Roughly, the billion people in the industrialised world accounted very much for the lion's share of global emissions. Total global emissions about 20 million tonnes CO₂. When we look at trends since then, up to recent years, on a slightly more fine grain, each of these squiggly lines shows the progression of various economies. So, for example, the odd one there, the blue, you can see Russia, movement from extraordinarily inefficient high emissions, the combined collapse of the economy and emissions and a recovery based upon much more stable emissions. You can also see in this actually the UK and Australia have actually had a very similar per capita economic growth over that period, but, boy, do the emission profiles look different.

Now, I use this chart to draw two essential points. Sorry, I hope I clarified, vertically again per capita emissions, horizontally is economic GDP per capita. Two essential points to come out of this chart, one is in a good classical economic framing you might expect the sort of economies to converge at a similar level of wealth to similar level of emissions, give or take trade differentials. Let me assure you, trade differentials are not the dominant explanation here. That has certainly not been the case. In fact, remarkably, over this period, per capita emissions in the industrialised world have been remarkably stable in most cases, with EU and Japan around the 10 tonnes of CO₂ per capita mark. France significantly lower partly because of ... largely because of its nuclear fleet. The US being about twice that level, and again pretty stable in

terms of per capita emissions. Australia is the main exception. It has been rapidly catching up with the United States.

The other main feature of this chart, obviously, is that the emerging economies are still kind of down the bottom left-hand corner but, you know, they're moving fast, their economies are growing, they're getting richer. Along with that they're emitting more, a lot of basic industrialisation. So far, they have not really breached the 10 tonnes per capita level and it's not quite clear, particularly if you look at that Korea one, an interesting element, hint of stabilising, to be seeing exactly where the emerging economies go in this pattern. But clearly, given the population scale, the global difference between whether the emerging economies end up around 20 or 10 or even five is going to make a massive difference to the scale of the global problem. And that growth has led to this pattern 20 years on, which looks very different from the way it did 20 years earlier, but we still see the differential between, if you like, the New World economies, large land areas, cheap resources and all that went with that pattern of economic development, and then, you know, the Old World economies, Japan, EU, etc, Russia having sort of gone back to that level. China now about half of that level, about a quarter of the US.

The maths here are actually very simple. At some point in the last couple of years, China surpassed the US as the major emitter but basically it's a four times as many people emitting a quarter as much per person. That's the basic mass of the US versus China dispute. I will, if time allows, come back to some of the trade effects. China would argue that actually the US remains responsible for far more emissions per capita because a lot of, you know, possibly a quarter of that is trade of carbon embodied in goods that China produces and exports for waste and consumption. And you still see a long tail of population emitting far less per capita as well. The potential for global growth is enormous if you think about what happens to the area of those blocks if and as the emerging economies and the rest of the world aspire towards the level even in Europe, let alone the level in the US, and as global population grows.

So it's quite a challenge, and I just want to summarise what I see as, you know, the key beliefs that have informed the politics of climate change in this era and what I actually think about those beliefs now. Before I get further into the techy stuff, I think the key belief internationally is this is essentially a problem of sharing costs. It is a burden-sharing negotiations we're in globally. I think actually it's looking like, much more interesting, it's about decisions on policy, investment risks, return, which are also driven much more by politics than by economics. Second, the inevitable way to construct the issue is leadership by the industrialised countries with others following. That was the legal principle agreed in the framework convention 20 years ago and everybody assumed that was the nature of the deal. We are actually now in an era we are discovering much more fractured action within the industrialised world and within the developing countries.

And then there's three policy areas which I'll be touching on more, but the first of which was, well, energy efficiency is really an easy free lunch. Lots of engineering data on how more efficient we can be. I think the evidence has emerged it's good for the economy, but it is not simple to deliver. It's not trivial. Carbon pricing was going to be, well, the obvious way. You know, believe in markets, yeah, it's easy, we'll just put a price on and that will drive low-carbon investment. It's actually turned out to be really tough and it has a more complex role. And the other and to some extent opposing belief put forward by those who really hated the idea of carbon pricing was technology will save us. Well, technology will do a lot, but innovation is again not simple and to a large degree emerges as a result of good policy. It's quite hard to force it efficiently and effectively, and it's quite slow to emerge, and I've got a certain amount to say about that. That's alright, you can go now, actually. I will have covered the essential points.

Okay, however, if you're interested to stay, I want to delve down a little bit into a few related areas before zeroing in on the carbon pricing. Just a quick word about the nature of the challenge. I hope and trust that most of you will know a certain amount about climate change, climate science. I have no interest in revisiting that territory. It's pretty basic physics that dumping carbon into the atmosphere warms the surface, and what this chart tries to show is a relationship between the science of climate change in terms of equilibrium temperature consequences against the amount of cumulative carbon emitted, and actually one thing scientists have realised over the last sort of five years or so is this is kind of the best link. I

mean, we actually all talk about concentrations in the atmosphere, but the strongest connection is between the ultimate temperature change and the amount of carbon that's been chucked in cumulatively to the atmosphere. There's a lot of climate ... a lot of uncertainty about the actual radiative forcing relationships, hence a substantial range of uncertainty vertically. The red line is the median prediction given emissions, and here what we see on the horizontal axis is that we've emitted about half a billion ... half a trillion tonnes of carbon so far, since the industrial revolution, and if we're going to keep to the sort of scientific guardrail that is widely talked about and actually adopted in some G8, we can afford to emit about another half trillion tonnes of carbon, and that takes us somewhere along here.

Interestingly, that gives us leeway potentially to burn up all of the conventional easy oil and gas that we know about, and to dig a bit of a way into the world's coal resources. Now, we could have a long argument about is that still too risky or is it whatever, whatever, but let me just offer it as a scientific fact. It of course is more complicated because there is an awful lot more carbon in the ground, and note that black line there is called Reserves Defined as Economically Recoverable Reserves at Current Prices. Beyond the conventional economic reserves there is a huge amount of carbon in unconventional oil and gas, and a lot more carbon still in all of the additional coal resources. All the bits of solid carbon that exists in the earth's crust is absolutely enormous. Please do not misunderstand me. There is plenty enough carbon in the earth's surface to really mess up the atmosphere very big time, but the amount that is cheap and easy and economic under current conditions is limited, and there's a reason why I've introduced that. I'll come back to that in a minute.

If we are going to avoid gobbling our way through all of that carbon and chucking it out we need to do two things: efficiency and decarbonisation of supplies. Energy efficiency is largely a ... the quickest and it's very interesting to look at this chart, I find, which is the relationship of energy, prices vertically and intensity horizontally, energy per unit of GDP is the horizontal axis, and you can see up there, Japan, pretty high prices but relatively high energy efficiency, low energy intensity. The cluster of EU countries. You can see Australia, the United States. You can see this long tail of the former centrally planned economies. What is interesting about this is that the ... any economists here would see the cross elasticity is bigger than minus one. If you chop out ... I'll say in a second what the effect means. Chop out Eastern Europe, that line becomes more like that and it gets about minus one, which basically means that the countries that have 10 to 20 to 30% higher energy prices, or more, in some cases – see Japan up 40% higher energy prices – use correspondingly less energy per unit of output: 10, 20, 30, 40. So actually the amount of money that countries spend on energy is remarkably constant.

The higher energy prices, it basically seems to come out the other end in terms of lower energy consumption, and one of the things I found slightly missing from this debate, as I observed it in Australia, is the idea that higher carbon prices times your energy consumptions equals your energy bill. It doesn't. Your energy bill is the amount of energy you consume after responding to higher energy prices times the energy price. Now, this is not an instant adjustment. In fact, there's lots of things buried in here, also including some trade effects which probably account for about a quarter to a third are trade related outsources of carbon intensive, etc, but there's a very substantial impact that is a reflection of energy efficiency. That in turn is a reflection of both a direct response to prices and other things that, in my view, go along with higher energy prices like just culturally this stuff is not so ... you know, it's not totally limitless and free to waste. We'd like governments to have a stronger program in terms of energy efficiencies, we would, you know, have more in the line of, say, a high speed rail instead of super highways, and so forth. So this is not a simple connection but it's a very important connection.

If we look at the actual trend of carbon productivity, well, we haven't been doing badly. We've certainly been making some progress. This chart shows the trend since 1980 essentially of energy per unit of GDP, carbon per unit of GDP. You can see the staggering inefficiency of the former centrally planned economies where energy was essentially free or very subsidised, and the enormous impact as they moved towards market-based pricing. China having a blip of a massive expansion of coal power, but now China's target is to improve its energy intensity by 40 to ... carbon intensity to 40 to 45% over the next decade. The bit I wanted to actually draw your attention to is the distinction of two quite distinct clusters, one of which is the US, Australia, also India, with also the former centrally planned Eastern European countries that in ... you know, in

the middle of this joined the European Union, started marketising the economies and their efficiency improved enormously.

There's lots of interesting tales in there. India is, I think, a fascinating one. But there's a cluster there and then what you see is that Japan and the European Union, countries that ratified the Kyoto Protocol with caps of substance, you know, a decade ago, in pretty clear blue water and they're sort of 30, 40, 50%, or substantially more efficient in carbon efficiency than the former group. And the EU has been slightly ... EU15, the Western European countries, when separated out, have actually edged a little head of Japan. Now, who ... and I should come back to that in a second as well, but I first want to check just who is acting here. Now, I do not have the possibility or the time to sort of go into depth. I just wanted to give you a flavour. EU has been doing various stuff. California had a highly politicised vote last November, an attempt to repeal legislation on cap and trade, and that was ... that proposition was roundly rejected, as a result of which California will be implementing a cap and trade system shortly. Brazil has nurtured initially a biofuels industry and now a much broader industrial and economic drive to be the developing world's leading low-carbon economy.

Looking across to Asia, Korea has by far the most green of all of the economic stimulus packages, strong emphasis upon developing a low-carbon industrial base. India is shifting to a low-carbon development trajectory. It's introducing a scheme on perform-achieve trade, which is essentially an efficiency cap on its industrial sector. China is doing all kinds of things. You probably hear more about it here than we do, but I was told shortly before I came here that the declaration of a new round of low-carbon development zones now probably comprise around 20 or 30 million people, and its five-year plan clearly targets some of the clean industries as areas where China wants to dominate the global innovation. Energy and carbon pricing is an essential part of the strategy in Europe. Renewal was a core in Brazil, and in EU, and emerging strongly in Asia. What's going on here? What unites all of these regions? They're all energy importers. China most recently. China switched in the early part of this decade, and I think there was a very fundamental point there about the politics of trying to do low-carbon stuff. You can argue there's a point about the economics, but I'd actually argue it's more to do with the politics.

But let me build on this, link it back to my earlier chart about fossil fuels and the atmosphere, because I think that we are at a very, very interesting time in history in this field. I think that we are seeing the very first signs of what could be a fundamental divergence in the world's economy. In the face of oil depletion, in the end of easy oil, let me put it like that, the stuff that just comes out when you stick a hole in the ground, there are two choices, two types of choices. One is you get better at digging further away at the fossil fuel frontier. You'll dig more of the ... you know, the sort of treacly stuff out of the ground when it won't just come up of its own accord. You get into Tarzan's oil shales. You get really good at maybe coal-based synthetic fuels. Lots of innovation, potentially. We can learn how to, if you'll pardon the phrase, screw up the atmosphere much more cheaply than we do at the moment on the high carbon frontier.

But there's also the low carbon road which means more natural gas, it means more renewables, maybe nuclear, fuel cells, electric transport and all of the infrastructure that will be associated with that. That's the low carbon road. We can learn to do that much more cheaply than we do at the moment as well. Which of those ... no, well, you might say, though, I would guess the common question is how much more costly is that low carbon road? And the answer is, we don't know. There is lots of learning, innovation and investment required whatever we do with the global energy system. This is not something where we can sit here without any cost for the next 50 years whilst fossil fuels do what fossil fuels are doing, only much more spectacularly, and pretend there's no cost. Which is cheaper/more expensive is partly a function of investment policy choice, innovation, and a lot of imponderables. However, we do know, pretty high confidence, about one thing. Low carbon futures are more capital intensive and they are less fuel intensive, so to some extent this is about placing bets based upon how far ahead we want to look and how much we want to just build stuff which is cheap to get it out of the starting box but leaves us dependent upon fossil fuels' volatility for the next several decades. Now, that's a strategic policy choice and governments have a strong influence through how they design markets as to which choices are made.

So let me now come on to some of the components of that choice, what I call the policy triad. Let me just ... well, I've slotted in here a couple of things just to remind us about the scale and the timescale of this challenge, because it's relevant to the instruments. We're looking to try and turn around a system which is shooting off in the wrong direction, these are global emissions, rapidly, in terms of something like an energy system, turn ... turnaround, get it shooting down. Really, the 50% global emissions target that's talked about is that circle in the middle and we need to keep going down towards the end of the century. I don't think we know really how to do the second half of this diagram. I think we know quite a lot about the first half, but there is no question that we are looking at a radically different kind of energy system that needs to evolve over periods of decades right through the century. This is a long-term gain.

Pathways in the UK, we've done a lot of analysis of pathways. I don't want to spend too long on this. Just bear in mind one basic fact. Faced with a dot of where we are now and a dot of where we'd like to be in 2050, in the UK now there is a target written into the primary legislation of the UK Climate Change Act that the UK government has to have carbon emissions in 2050 80% below 1990 levels. That is not for the faint-hearted. Given that, most people tend to sort of draw a straight line. They think, oh, we need to go down in a straight line. A lot of the policy pressure is actually to go a bit more slowly. You know, kind of, you know, we're not quite ready for that. Let's ... you know, I want to do a bit more development, etc. Any mathematicians in this audience will immediately spot the fact that if you start with straight line between now and a minus 80% reduction, you can start with about 2% a year reduction, and by the time you get to mid-century you're looking at an 8% a year reduction. That's probably not a very efficient way to try and design your policy. It's likely to be a lot smarter to actually do an exponential curve, constant at around, you know, three and a half or so per cent.

So, you know, thinking about the long-term reorientation and starting to get on with the job as fast as we can is fundamental to good economics in this space, but that is a sort of framing for, if you like, a second thesis I want to put before you, which is we've become a bit too obsessed with just carbon price as the only thing that drives things. It doesn't. We're complicated systems. There are three timescales we need to think in terms of. There is a short-term where energy efficiency is probably the quickest win, various gains can be made pretty ... and we've seen a number of them in Europe in response to various policies. There's a years to decades, where probably the biggest component is substituting low-carbon investment for high-carbon investment, and then there's a sort of long-term game here about innovation, about the infrastructure. How much we emit by 2100 will still be affected by choices that we make on urban design and development, airports, even rail connections, even building stock has an extraordinarily long timespan.

This is kind of interesting because against each of these are different analytic principles on the right, and as an economist speaking, you know, too much of economics, in my view, gets captured entirely by classical economics, which is about substitution price based. There's a rich literature around behavioural economics, of how people really behave and why people really waste so much energy and what they will and won't do and so forth, and there's a rich literature on evolutionary economics which basically emphasises that the economies we have are a strong function of history, a strong function of what have we built in the past physically, what infrastructure do we have, what innovation have we done, what institutions have we created and so forth. We need to think long-term and we need to address all of those three components.

This is sort of an added at the last moment slide thanks to a comment from Christian, but I do think I should stress there's a kind of belief that if you get a carbon price the innovation will flow. Well, you need to understand the structure of innovation in our economies. Pharmaceuticals spend close to 20% of their ... what's it, over 15% of total revenues on research and development. The IT sector, it's around 10% of turnover gets spent on innovation R&D. A scattering of other things. Electricity construction and materials, about 1%, and indeed oil and gas producers and gas/water multinational. That can be slightly misleading because some of the engineering firms are in here that do supply these, but we are seeking radical innovation in some of the least innovative sectors in our entire society and there are structural reasons for that that I don't have time to go into, but simply putting a carbon price on it will not solve the structural problem of innovation in these sectors. We need policies that do.

So this is kind of what this is building up to, which is to say that we have a three-level problem which needs to be addressed by three pillars of public policy. We have challenges around innovation and infrastructure, the long-term where the dominant policy instrument has to be public-led investment. We have a challenge around substitution of high-carbon for low-carbon investments, where carbon pricing is the instrument that will have an impact in market economies. It will have spill-over effects also in increasing innovation and in efficiency, no regrets. And in that third level, we need to look at how the energy markets and systems work, all of the barriers and failures to energy efficiency, all of the behavioural economics, etc, etc. And just to really ram home this point, these three levels and these three pillars are all quite intimately interrelated, if we're going to get serious about this, this huge transformational challenge. I don't want to spend too much time on this, but just to simplify the tale, carbon pricing sits at the centre of this web, in my view. It actually reveals ... it's a way you can reveal how costly some of this is, and the preference is there, and here's some of the options that work. It also can provide funding for the public-led investments in the long-term. It also can provide the motivation, in part, for consumers to be more efficient. You know, there's nothing like a kick of higher energy prices to make people actually think about optimising their energy use in the first place, but by also ... there's a feedback there that as people get more efficient, higher prices become more acceptable.

Bear in mind my charts. The amount the countries spend on energy per capita is remarkably invariant because of the feedback loops between price and efficiency, and that's one reason why what one might predict to be the case, namely that countries' economists would tend to look at my early charts and say, well, clearly countries that are emitting 20 tonnes per capita instead of 10, it's far easier to cut emissions and to cut ... you know, it will be more efficient and introduce carbon pricing. Rubbish. Countries that are more efficient will find it politically easier to introduce carbon pricing and get on, if you like, a virtuous circle, whereas in countries who are emitting 20 tonnes per capita, like the United States, you've got populations that are very heavily dependent upon cheap fossil fuels and vast producer interests that want to make sure it stays that way. Political scientists would look at the difference and come out with exactly the opposite conclusion from the economists, and I have to say, looking at the outcomes and looking at what drove those outcomes, that happened to include ... the only estimate I've seen, which I'm sure is far from perfect, is that the US fossil fuel industry spent 500 million pounds on lobbying against the cap and trade scheme in the US last year. That's a hell of a lot of money to spend on PR campaigns, and that is a measure of what we're up against in actually trying to get the logical and efficient instrument into place to try and get to grips with carbon in a market economy. Yeah, you can fool an awful lot of people with \$500 million.

So that brings me to the final area, carbon pricing in Europe. What have we done? What have we learned? Where is it going? How do we do it a little bit? Well, first let me please make plain that I don't think the European Scheme is remotely perfect. I think it had one real stroke of genius which was designing at an evolutionary way so that when we did embarrassingly stupid things we could improve it over time. That's not fair, that's ... you know, but you'll see what I mean. The design of the European Scheme, here you basically see in 1990 what European emissions were. 2005, the split between the sectors that are capped under the European Scheme and those that aren't. The European Scheme caps direct emissions from power and heavy industry in the EU, and it started in 2005 with a three-year phase. Moved on to a five-year phase, and that ends at the end of next year. We then go into an eight-year of phase three.

By the end of phase three, it gets to 2020 and the capped emissions are probably still around 40% of the total. If I had time I'd say what we do about the other 60%, transport, domestic and so forth. The current European target is to reduce emissions by 2020 to 20% below 1990 levels. The phrasing would be if there is an adequate global deal, Europe would move to a 30% reduction, which is this right-hand column there. Just one thing I've put in there is a reminder around the ... there was an MIT study of how much emissions have actually been saved by the European Cap and Trade Scheme, and their estimate was 50 to 100 million tonnes of CO₂ in its first year, and that ... and I think I may have added, oops, in this one. Yeah, you can't ... you can hardly see it but this shows ... sorry, I'll come back to the squiggles in a second but just to continue ... finish that theme, in the first three years of operation, the MIT study estimated the European Scheme saved somewhere between 120 and 300 million tonnes of CO₂, which is somewhere between, sort of, 2 to 5% of the overall capped emissions. It's quite hard to

estimate because you're looking ex-post, looking after the event. You know there was a gap between the amount that was allowed and actual emissions and you've got to attribute it between, you know, what was surplus allowances and what was real cutbacks.

What the squiggly line shows is the evolution of the carbon price in the European Trading Scheme. It started out at around 10. Gas prices at that time were pretty low. They were ramping up. It was considered switching from coal to gas was the major emission reduction option, hence as gas prices rose, the carbon price rose. When it got to 30 people thought, blooming heck, it can't go higher than this. It decoupled, bumped around for a while, and then in April of 2006 companies ... the submissions of companies, the verification reports of companies, were published by the European Commission, and lots of companies submitted reports saying that actually their emissions were lower than they had projected or expected and they cut emissions by more and they had a substantial surplus of emission allowances and they were really looking forward to selling them, because all of their industrial competitors they knew had been saying that they were really short of emissions and it was going to ... and of course they actually discovered that everyone else was telling the same story, and once you discover that everyone else has got a surplus to sell as well, and you can't find any buyers, the price collapses, which is what happened in Europe, and in fact it struggled for a little bit and then finally the price in phase one collapsed to zero.

It's a very interesting tale because all of, sort of, the environmental communities said, oh, a disaster, this trading scheme is a complete waste of time, and after a few weeks of shock, the industry said, but wait a minute. I mean, you know, we've cut emissions by more than we thought was possible, more cheaply than we thought was possible. Why aren't people congratulating us? This is a major success. And of course some truth in both. Anyway, the carbon market traders weren't too phased by the collapse. They moved into future trading for the phase two of the Trading Scheme, which is the yellow line going on to the actual trades in black. Again, bumped around 20 to 30 Euros per tonne CO₂. The recession came in, some other factors suggesting that the market was nothing like as tight as again had been said. Price collapse close towards 10 and sort of recovered to the region of 12 to 15. Where, incidentally, it's bumped along in that range for pretty much two years now, slightly, to my surprise, I confess, I thought price volatility in this system was quite a problem, it looks like it has become a lot more stable as the system has grown and matured. You've got more market facilities. You have banking allowed of allowances can be put forward into phase three, so people are looking right out to 2020, taking a long view on how valuable will these allowances be.

But I do think in the ETS, and let me say every other price-based environmental regulatory system that I have been able to discover, it has ended up considerably cheaper than anyone really expected or projected, and one of the points you've always heard about market instruments is once they're in place, once an incentive is in place, things pop up that you just hadn't quite thought of. So, for example, in Europe, everyone who'd really focussed on switching coal to gas actually discovered you could switch different grades of coal as well, and then the cement manufacturers discovered that having said, well, cement is cement and it's processed emissions and why on earth bother to price this because there's absolutely nothing we can do, discovered you can make cement more efficiently. You can mix biomass, and also you don't have to use cement ground out of 95% of clinker, which is the primary carbon intensive thing that goes. You can mix in flyash, other stuff, and the industry cut to 90, 80% ... 75% clinker going into cement, big emission reductions. Second-biggest source of emission reductions in the European Trading Scheme was changing cement operations.

Now, to start zeroing in a little more on to what it does mean financially in Europe, and I'm moving towards the end. I know I've covered a lot of ground. Well, I know I've covered a lot of quite technical stuff, but if you can kind of just hold for a second because there's a big debate in Australia about is this going to wreck industry, costs, losses, etc. What this chart tries to explain is that any sector has a potential to either lose or gain depending on the mix of two basic determinants. One is vertically you've got a measure of profits in relation to how many free allowances does it get, or how many oil tins does it have to buy, and if you like that red line is current profit margin and let's ... these numbers have got accord roughly with the steel sector. If they get everything they emit for free, they'll still be subject to a little bit of cost impact, because of electricity price feed through.

As they are given less and less and less free allowances, obviously their profit margin goes down. They've got to go and buy the carbon. But that's if an industry is sitting there and doing nothing to its product prices. Along here is how much is the cost of the product ... the cost of carbon being added on to the cost of the product, and clearly even a sector which has to buy all of its allowances ends up more or less, you know, cancelling out a loss if it passes all of the costs of carbon thrown on to its product. In the case of steel I think this was 30 Euros a tonne. That would mean increasing steel prices by about 10%. In Europe, one of the things we realised, which to be honest some of us economists had warned but nobody really quite believed, is in a lot of markets the cost will be determined by the actual price of carbon, irrespective of how many free allowances you've given them. Because if you're running a coal plant and you're selling electricity, if you're sensible and you want to maximise profits, which, on the whole, you'll see companies want to do, then you want to add that carbon cost on to the price of the electricity that you sell, because if you run the coal plant, you've got to buy those allowances or if you don't run it you can sell them. That is the cost you add on. That has nothing to do with whether you've been given 95% free allowances or not. So the price of electricity is actually independent of things.

Europe, it started giving out all these free allowances here, discovered that the carbon price was actually being added on to electricity anyway, and so electricity was earning up in the top-right of this parallelogram and making shedloads of windfall profits. This was not a game, this was not unfair, this was not unreasonable, this was just businesses doing their business of maximising profits given the circumstances. But it was deeply politically embarrassing. Now, having basically needed the reality proof of the markets operating, you may not be entirely surprised to know that after eight years of free allowances Europe is moving to full auctioning in the power sector, and there's still a lot of conclusion, even today, if somebody said, oh, wouldn't that have a massive consumer price impact? Isn't there a lot of opposition to moving to auctioning in the power sector? And the answer is, no, everybody's agreed to it. Because the consumers pay the cost of carbon anyway, and the producers knew that eight years of windfall profits was probably about as much as they were going to get away with.

Different sectors end up in different places on this diagram. If you face severe international competition, something like aluminium, more or less a global spot price, your room for manoeuvre in raising aluminium prices is very limited. If you're cement and you're selling inland and protected by transport costs which are very high, you can basically be just like electricity and do really nicely out of it, thank you very much. So the challenge for the government is to actually think not just about the vertical axis here, but far more important and difficult, the horizontal axis. How will this sector respond to a world of carbon pricing? And I think there's very few sectors for which the answer is they will do absolutely nothing in their product prices. You know, I won't go into sectoral details, but the challenge is what that unfortunately means is it's not very good economics to try and treat every sector the same way. In fact, it's bad economics. Sorry, another complicated techy chart, again thanks to Christian's comments to me on the way, but let me just stress ... my apologies here. Oh, I say, what am I doing here? I think I've just broken this, you know. Does it just slot back in alright? Alright. Thank you very much. Okay. Okay. Thank you.

Just want to emphasise one thing about this space. Carbon is very concentrated in our economies, at least on the production side of economies. What this one tries to show is the costs of carbon relative to the value added of a given sector, again its contribution to overall GDP, and this is EU aggregate numbers and you see, you know, the vast majority of European production, you can hardly see the carbon costs. The manufacture and carbon construction actually is surprisingly low. There's a small cluster of primary commodity industries, which we've kind of exploded out in the middle bit of this diagram, headed by cement, which is incredibly carbon intensive relative to value added, and so what you have to understand about the economic impact of climate change ... of carbon pricing is this is not something which wrecks the economy. This is something which is a challenge to about half a dozen primary commodity industries.

Now, in Australia, that ... in Europe, that's about 2% in ... 2% of GDP rests in these potentially trade exposed and very carbon intensive sectors. In Australia, given the different nature of the

economy, I believe the Garner Report suggests it's around 5%. But again one has got to understand the structure of the economic base of the problem if you're going to get a sensible policy and avoid some of the crazy things I hear on the airwaves sometimes. This is a problem about how do we handle a problem around half a dozen primary commodity sectors when some parts of the world are putting a price on carbon and others are not. Well, interestingly, conceptually, this is really easy to think about. It really is. There are only three possibilities. And sorry, and I should have said, by the way, I think carbon leakage is a really serious problem, but it's a problem that needs to be informed by proper economic analysis and understanding. The reason it's a really serious problem is because, to my mind, no politician is going to stand up and say, oh, sorry, we've lost part of the steel industry. Sorry, we've closed down a few plants, lost a few jobs. By the way, the stuff's gone abroad and they're still limiting. It's really bad politics, if nothing else, and it's no good for the environment. So no political system stands up to lobbying around carbon leakage. They all fold their hands very, very quickly.

So what are the options faced with this? Well, as I say, actually, there's only three things you can do. One is to do something to take the carbon cost out again. These two charts show carbon price within trading scheme, and then in the rest of the world, if the rest of the world is not having a carbon price, and you adjust the costs downwards. Problem resolved. Mm, except for some problems that I'll come back to, which are actually pretty obvious. The one you'd really like is if the rest of the world, the entire world, put a carbon price onto the production of this product all at the same time and all at the same level of carbon price in the same way. Anyone want to put a guess about how long we could wait? I think probably the answer is forever, because you would essentially be ... given the realities of political cycle, you would never align all countries at the same time to do the same thing, but it's certainly a very, very, very long time. No journey was completed by everybody jumping exactly at the same time and everyone saying we ... we know that.

So the third option is to adjust costs at the border. Stuff consumed inside the region pays a carbon price irrespective of where it's come from. Stuff outside of the region, if it's going to a region that doesn't have a carbon price, may get its costs reimbursed at the border. There's border adjustments. Yeah, there's lots of detailed and interesting debates about how to design these different compensation schemes, incidentally. There's lots and lots of variants, but I don't have time. I did just want to stress a few points. First, and this comes, as you can probably guess, out of a talk where I was asked to talk about the myths of carbon leakage, there are cases in which free allocation actually turns out not even to solve the problem you thought it would solve, and a couple of examples, if you take something like cement, the European Scheme would give a cement plant eight years of free allowances. Cement is so sensitive to carbon prices and relatively low capital cost. You might well find that you make more money selling carbon allowances than selling cement, and if you're a cement plant right near a postal court that's got port handling facilities, you may say, fine, I'll run my plant down and import the cement and flog the allowances, which is not quite what the purpose was, particularly as your inland cement producers may be raking in windfall profits the way that the electricity sector did. We have a problem with cement.

For other introduce an investment ... yeah, it kind of works, except, of course, it's a big capital and they want to know the rule 30, 40 years out. Will I be protected against carbon prices for 30, 40 years? Well, Europe has sort of refused to answer that question to some of its major industries, which is still part of the problem in the political debate. I think it's also important to stress that free allocation is not free. Protecting the energy intensive bits of the economy inevitably requires the rest to work harder to reach a given target, and, frankly, it's very difficult to design compensation in a way which preserves all of the incentives you're after. In fact, it's almost impossible. I don't want to run through too much of the detail there, but if I were to pursue further the cement example, you have a problem that, you know ... I mentioned the clinker and the cement going into cement earlier, and you have a real problem that if you say, okay, we'll give you free allowances per tonne of cement you produce, well, they can say, great, that's really nice of you. Do you know what? I think we'll import the clinker anyway. So you say, no, no, that wasn't what I meant. I'll give you the free allowances for the clinker, in which case you've lost all of the incentives to use clinker efficiently when you make cement and when you make concrete out of cement and when you make buildings, nothing carries a carbon price.

There is a real cost associated with free allocation. Economically, there is no question you're better off doing something at the border, in theory. Very important indeed, if I'd like to make one sort of takeaway message, is be careful, in part because there are two totally different border adjustments discussions out there, one of which is essentially, well, we want to do stuff at the border because other countries ain't pulling their weight here and we kind of want to beat them up. It's explicatory discriminatory, using trade measures to gain political leverage. That is a big no-no. It is protectionist. It's actually quite dangerous economically. But it is very different from simply saying, we want to levelise carbon costs at the border. In principle, that's just doing what it says. It's actually preserving the carbon price consistently between production and consumption and it's intrinsically not discriminatory between countries. So carbon leakage based on reality is ... the first one is it is not necessarily the best general solution to protect our entire economies with border adjustments and pressurise other countries.

You don't need to protect the whole economy. At most, you're talking somewhere within 2 and 5% of the economy involved in industries which have any plausible fear of carbon leakage, and if you use it in a discriminatory way against other countries, you end up in a horrible place in terms of political and trade relations. But nor does it follow that all border adjustments are discriminatory and threaten trade and political relations, well, at least because we already do it. Value added tax, or GST, is it, here? It's a globally harmonised system for border adjustments of taxation systems. Excise duties we levy on petroleum. I would imagine you do here a little bit, but in Europe we've got substantially higher petroleum charges. Do you really think petroleum ... Europe sort of has a huge tax on domestic refineries and says, ah, but if the petrol comes in from outside we don't tax it? No. We have border adjustments. The world trade organi ... someone said to me in the WTO, what is all this talk about the WTO would oppose any country doing border adjustments? The WTO is a system for specifying what are legitimate and what are not legitimate border adjustments, and that is very close to my final comment. I just thought I'd quote from a recent World Economic Forum paper which was actually launched in December by the Mexican Trade Minister which tried to drive home this point: can we please get more sophisticated in this debate around border carbon cost levelling because the WTO does not want to be blamed as the obstacle for countries to do the right thing and have a rational carbon price.

Final comments, well, actually, that, sorry, perhaps could have come earlier. That's just an illustration of the key sectors we're dealing with. Again, point, limited number of primary commodity sectors, within which iron and steel and cement, on their own, those two sectors account for about a third of emissions directly, which is the dark area, and a bit more in terms of the hatched electricity, and then there's a tail of other industries, but, you know, we can do this. We can deal with these half dozen key sectors and get a very long way. You do not need to get into a huge tale of debates about automobiles and other stuff. Well, I apologise, that has been a rather long journey and I've perhaps been a little overambitious but there was a fair amount I wanted to pack in, and having now had a few days here in Australia and reflecting on the debates I did want to try and in this talk weave together a number of previous talks I've been giving in Sydney and Canberra of which I'd say key points, economies appear to now already be in the very early stages of starting to diverge in terms of their carbon intensity around the ridge of oil depletion.

To sustain the journey towards deep emission reductions you need multiple policies. Carbon pricing is at the core but it is not the only pillar. There are three essential pillars of policy. Carbon leakage, the ... sort of the principal thing of the talk I was asked to address, is a big challenge. You cannot ignore it, but the current practise of free allocation of basically taking the carbon cost out of anything that threatens to move is not sustainable as a long-term solution. In my guess, that is likely to give way to border carbon levelling, at least on imports, probably by 2020. A logical system to develop here would basically be a carbon added equivalent of value added tax adjustments. That is the logical thing. Each region says, he emitted as much carbon here, this is how much carbon has been paid for. You hand that information on to the next jurisdiction that says, okay, we'll only charge the remainder, the addition. And here is a core political proposition. This is my sort of final point in this. I think we are now beginning to see the emergence, the very early stages, of a low-carbon coalition. EU is doing a lot of talking with India, China, Brazil, given up on Washington entirely, and is that low carbon coalition going to be fundamentally a club of importers, energy importers designing the rules on how we deal with

carbon and import dependency, or are there going to be at least some major producer countries that manage to deal with the politics of carbon pricing in producer countries to get at the table those countries that are also trying seriously to get on the low carbon road, and I very much hope the answer will be yes, and on that note I shall finish. Thank you.

MIKE: Thank you very much, Michael, for that wide-ranging view of the challenges it faces and some of the opportunities and experiences. As a way of introducing an opportunity to tease out some of those themes that have been picked up there, I have on the panel here, two esteemed colleagues who have been closely engaged with various aspects of this debate. I have Professor Robyn Eckersley, who's Professor and Head of Political Science here at the University of Melbourne. Robyn is very well known for her contributions in environmental political theory, international relations, global environment politics, and I also have Professor John Daley, CEO of the Grattan Institute co-hosting the event tonight. John is a PhD in ... from Oxford but ... and a long history of involvement in public policy at the intersection of public sector, private enterprise of academia, worked in Victorian Department of Premier and Cabinet, McKinsey and ANZ for many years before joining and forming the Grattan Institute, and I'd like to remind people his first degree was in Science here at the University of Melbourne, so he brings a broad perspective.

So just to start off, Michael threw out a challenge there halfway through. He perhaps didn't realise the challenge could be picked up so early on when he said that economists and political scientists would look at the challenge of carbon pricing in fundamentally different ways. Fortunately, we have Robyn here to take up that challenge briefly. Obviously a challenge which is far too diverse to explore in full here, but the issue of border tax adjustments is a big issue and throws up many of the concerns about global environmental politics, and issues to do with how we deal with differentiated responsibilities between developed countries and developing countries, who's required to take on the lead role? Clearly it's a very pertinent issue in our own environment here in Australia, and, Robyn, would you take up that challenge that Michael's given us?

ROBYN: Yes, yes, I'd be happy to. The point ... I've been given five minutes here and what I want to do is make some key points in a research paper I've recently finished on the politics of carbon leakage and the ethics of border tax adjustments, because we've heard a lot about the economics and something about the politics. I'll stay a little more about the politics and a bit more about the ethics. Michael Grubb has reminded us that the framework convention on climate change imposes a leadership obligation on developed countries to take the lead, and that's on the basis of burden sharing principles that are called common but differentiated responsibilities. There's a very simple idea that those that are mainly responsible for the ... most of the cumulative emissions in the atmosphere, who also happen to have the greatest capacity to pursue mitigation and adaptation, should take the lead ahead of those countries that have not contributed much to the problem, don't have much capacity to contribute, and in many ways are the more vulnerable parties. So this is a very important burden-sharing principle, common but differentiated responsibility, and it's been reaffirmed by the parties to the negotiations over a nearly 20-year negotiating history, so it's fundamental, and China and the G77 have led all the parties in holding the developed countries to that responsibility, and that's why, under the Kyoto Protocol, only the so called Annex 1 countries, developed and industrialised ones, have mitigation emission reductions.

Okay, so we've heard about border tax adjustments as a possible means of levelling the playing field certainly for the emissions-intensive industries, so I just want to explore the politics of that. The argument there, of course, is about levelling the playing field and immediately we have a problem, because as soon as you level the playing field, then you're starting to not fulfil the leadership obligation. This is, you know, from a developed country point of view. The point of putting a price on carbon, of course, is to make the polluter pay and this is naturally going to affect the profit margins of fossil fuel intensive industries. But we need to be very careful here and distinguish between competitive disadvantage on the one hand, and carbon leakage on the other. If we are to ratchet up or make stricter regulations on the tobacco industry, for example, should tax payers be required to compensate the tobacco industry for that profit loss? I would suggest not. So if we put a price on carbon and fossil fuel intensive industries and going to suffer loss in profits or even asset values, should the tax payers be asked to compensate that? I

would say no. However, if you have a regulatory scheme that puts a price on carbon and that actually does drive some industry offshore, they take their emissions with them and continue pollute every ... somewhere else, then that is a regulatory failure, and as Michael Grubb said, carbon leakage is a serious problem. It's not a problem if industry migrates and starts using hydroelectricity. We may have lost the jobs, we may have lost the investment, but there's a net reduction in emissions and that's a good thing, so the regulation is working. So the problem is only when you put a price on carbon and there's some industry location and there's a net increase in emissions. We clearly don't want that. However, we don't want compensation for compensation's sake, because what that does is hollow out responsibility of the rich countries to take the lead and postpone the necessary restructuring efforts.

Okay, so we can distinguish between competitor disadvantage and carbon leakage, so what are the policy options. Well, in the European Union it's been free allowances for the emissions intensive industries. They did enable that for the power sector for a while, but they just got windfall profits, and so they're moving towards full auctioning there. In the US, of course, cap and trade is off the agenda at the moment, but it was very much on the agenda in the 111th Congress and it got to the point where a bill was passed in the House of Representatives, the Waxman Markey Bill, which put a price on carbon but also had a border adjustment system in it, as did many of the bills that had been put forward in previous congresses, and as did the Senate bills that failed to get up. In that instance, the bill required importers to purchase the equivalent allowances on their domestic trading market as if they were domestic producers. Now, this was justified as levelling the commercial playing field, but it absolutely caused China and India to get very angry. In fact, in the lead up to Copenhagen, they put forward negotiating texts to outlaw border tax adjustments because they called them backdoor targets, and this, everyone said, would poison the negotiations and fundamentally subvert that principle of common but differentiated responsibility which says if anyone's going to take a hit it should be the developed countries. You don't pass it on to the developing countries. It's acknowledged that we cut a little bit of extra space in the atmosphere for their growth because they have serious development needs. We don't want to kick the ladder down behind us.

So the argument for border tax adjustments has always been to prevent leakage, there hasn't been a lot of evidence of this so far, but we will see more of it as the price of carbon goes up; to provide leverage, that is to encourage other jurisdictions to impose a price on carbon, but it's not going to impose much leverage on developing countries who don't ... who would just simply see this as backdoor targets; to protect industry from competitor disadvantage, I've argued that's not a legitimate policy option; or to garner political support to get legislation through, you know, basically through the legislature, and certainly that's why it was in the Waxman Markey Bill and many other bills before Congress in the US, although that's now history with the midterm congressional elections.

But there are problems, of course. You could set off a tit for tat carbon tariff war. It's an option that maybe is only available to the larger trading nations, not smaller ones, and of course the core problem is that it's incompatible with a principle of common but differentiated responsibilities. Of course, international sectoral agreements amongst the few energy intensive industries that Michael Grubb referred to would be the first-best option, but it's not going to happen. There was a push, and there still is a push in France, to impose ... in the European Union led by France, to impose border tax adjustments as the price of carbon rises to protect European industry, and France for a while talked about a Kyoto tax, that is a tax to penalise developed countries who had not ratified the Kyoto Convention and to punish them as laggards. You could imagine what that would do to transatlantic relations. And of course, if you designed a discriminatory tax that singled out developed countries that weren't fulfilling their leadership obligations, you would definitely end up before a dispute resolution panel in the World Trade Organisation, so it wouldn't be especially productive.

So, clearly, if you're going to design border adjustment taxes, for example have a tariff on imports and a rebate to our exporters, then they would have to be non-discriminatory. You'd have to respect those principles of the trading ... the multilateral trading regime. But if you do that, then you've got firms in China that are exporting into Australia who are paying a price at the border that comes into our consolidated revenue. It helps us to decarbonise. So effectively you've got Chinese firms subsidising our decarbonisation, an absolutely perverse result in terms

of the broad burden-sharing principles of the UNFCCC where developed countries have an obligation to not only lead in mitigation but to assist developing countries in pursuing both adaptation and mitigation. So that's perverse.

So, in the 30 seconds I probably have left, what's the solution? Well, one solution is to recycle the money at the border, to recycle back to developing countries. Obviously you don't want it to go straight back to the polluter, that would totally undermine the point of the regulatory exercise, but certainly back to countries to assist in decarbonisation there. An even easier system would be to allow eligible exemptions for importers or exporters from elsewhere importing stuff into, say, a developed country. To get an exemption if they have a comparable export tax, and as it happens, China does have export taxes on some of these very industries we're talking about. Steel, for example. And that it's done this to actually improve energy efficiency in China. So, for example, if we were to design such a scheme, we would already be able to provide eligible exemptions to the Chinese. The advantage of that is that it avoids the problem of recycling revenue and attaching conditionality to that, which would probably cause some affront, certainly to the Chinese, but the fact that they already have export taxes I think addresses that problem. So it is possible to design these border adjustment taxes in ways that remains true to the principle of common but differentiated responsibility, and doesn't have that money coming into a developed country to assist decarbonisation, rather than going back to a developing country where, in many ways, it's perhaps more sorely needed. Thanks.

MIKE: Thank you, Robyn. It certainly seems to have some virtue of simplicity. To speak here entirely as a geologist, one of the problems, it seems to me, of applying moral principles here at a high level is that you very quickly degrade into economic quibbles from which you lose sight of the broad principles. So, as an economist, Michael, would you like to respond in any way to some of the comments that Robyn has made?

MICHAEL: Yeah, I'll just say I think you've ended up in the right place on that. I'm inclined to agree. I think that what you sketched is, you know, broadly a sensible way of looking at it, and in fact I ... in October I was in Delhi, partly to talk with some of the research community there about the sort of issues on carbon leakage and border levelling, and I slightly thought I'd get sort of torn apart, but actually they, themselves said, well, you know, really the solution would be to recycle the revenues that are raised at the border back to support low carbon development plans. So, yeah.

MIKE: Thank you, and we'll continue.

MICHAEL: I could carry on for ages if you wanted, but anyway.

MIKE: You could, but we'll bring John into the conversation here now. Clearly, our challenge in Australia is doing something in this space, and I want John ... can you comment on how international developments are framing, hindering, causing our own responses to evolve here in Australia?

JOHN: Thank you. I think what was really helpful about Michael's talk is that he kind of presented us with an old paradigm which I think has very much dominated a lot of Australian domestic policy development and suggested that maybe the world is moving into a relatively different paradigm. So we have an old paradigm in which it's all been about developing ... sorry, developed countries leading the charge, it's been about a large top-down agreement, it's been a world in which there would be lots of money transferred essentially from developed countries to developing countries as the developed countries paid for abatement opportunities and low carbon developments in those developing countries, and that's the world that we lived in, and it's one which if you even look at the Australian Treasury's own modelling of what we are supposed to do in Australia, it's one which I assume that there'd actually be relatively little change in the Australian economy, but the Australian firms, essentially, paying for an awful lot of free permits ... sorry, for an awful lot of real permits, not free permits ... an awful lot of real permits in developing countries. Those were the assumptions that were essentially built into the modelling.

What I think Michael has very helpfully done is say a lot of that paradigm may nor may not be morally attractive, but it's certainly not a very good description of what is going on politically. We are no longer seeing a big split between developed and developing countries. Instead the major cleavage is between those countries that are essentially energy importers and those countries that are essentially energy exporters, because the politics plays out so differently, because in countries which are energy importers the issues around energy security play out loudly in the domestic politics and therefore suggestions by the government that it will essentially increase the cost of energy, restrict fossil fuel imports and so on, tend to play quite well, whereas, if you are ... and you can see exactly that kind of thing going on, for example, in the UK at the moment as well as in many other parts of Europe, and conversely, in places like Australia which are energy exporters, the idea that we might voluntarily increase the price of energy seems very strange. Why would we want to voluntarily change our economy?

Now, I think the implication of changing your world view like this, the implication of going to a world in which we say the dominant cleave on this issue is going to be between importing and export ... energy-importing and energy-exporting countries is ... a top-down agreement is in many ways quite unlikely. On the other hand, significant action from those particularly energy-importing countries is very probable. As Michael points out, border adjustments are a distinct possibility if not likelihood over the medium term, and that I think changes quite radically how we think in Australia about what might happen and what we might do domestically, because if we're not in this kind of top-down world of big global agreement, developing ... sorry, developed countries essentially paying lots of money to developing countries, but instead we're in a bottom-up world in which some countries take very active steps, the consequences are different. So, for example, it means whatever Australia does, large-scale international trading may not be a major part of the whatever is happening globally, and indeed I'd suggest we are seeing many of the international trading mechanisms, such as the clean development mechanism, if anything, falling apart and becoming less important over time, rather than becoming more important, and the implication of that for Australia is that we are not going to be able to hit any kinds of targets by simply buying lots of permits from overseas. Instead, we are going to have to do this by changing our own economy.

It has a second and, I'd suggest, quite subtle impact on policy. If you think that the main game is about a top-down agreement in which there's going to be lots of trading, you are very reluctant to create a floor price for carbon, because it essentially means that your carbon regime will not be able to interact very effectively with international regimes. If, on the other hand, you say, look, this is mainly about every country doing its things and trading is just not going to be that big a deal, then you might become much more bullish about floor pricing because you say, we're not going to be trading this stuff anyway, so we might as well create a floor price. The easy way to do that is to have a tax. For every tonne of carbon you pay a tax, and then if you want you can have a trading scheme on top of that, and if you emit a tonne of carbon you must both pay the tax and go and buy a permit. That's a very problematic regime if you've got lots of international trading. Without international trading that becomes a relatively simple policy solution and it has the enormous virtue that it provides real certainty for businesses that are thinking about implementing capital investments that only pay off if there is a reasonably substantial price for carbon.

So what I'd like to suggest is Michael's given us a really different view of the world in which he says we have an old paradigm, which may be, I'd suggest, morally and ethically very appealing but it's not a very good description of what's happening, and given us a different way of looking at the world in terms of cleaving the world between energy-importing and energy-exporting countries, and suggested that our ... that's a more likely outcome, just as a matter of description. I'd suggest that has implications for our domestic policy. Perhaps the last place where it has implications, and I guess it's what Michael was picking up in terms of just as he finished, asking where does Australia fit into this, there is a world in which Australia simply takes the short run view. It says the marginal cost to our economy of shifting to low carbon solutions is quite high. We don't want to pay that cost in the short run so we will continue to be an energy-exporting country and we'll hope that all of this just goes away.

As Michael has pointed out, by the time we get to 2020, let alone 2030, that may not be such a great strategic position. We can imagine a world in which energy-importing countries are doing

two things. Firstly, they're imposing quite substantial border tax adjustments, and secondly, precisely because they have made the large capital investments, they're actually starting to wind up with relatively cheap energy. It's no longer so much more expensive than ours, but because they are effectively 15 years down the track already, and because it takes a long time to shift an energy system, it's going to be difficult for us to make that catch-up. It strikes me that's quite a bad strategic position for Australia to be in, and therefore that may be one of the key arguments for Australia to take the road that Michael was suggesting of breaking ranks with other energy exporting countries and saying, although the short-run temptation is to simply not do very much, that leaves us in a long-run very, very poor strategic position that we would be wise to avoid.

MIKE: Thank you, John.

So perhaps embedded there there's a hypothesis that this export/import divide is forcing us to pick a route in Michael's divide around the end of cheap oil, but it has to be somewhat more complex than that in that ... in detail, the country sectors, across the various sectors in the energy space, imports and exports, play out quite variably, but it's not quite clear how that dictates the US situation of going down the high emission intensity side of the divide. Have you got any comments about that?

MICHAEL: I think, like many things, it's more complicated when you look at a finer grain and, of course, in this there is the fact that, of course, the US is now an energy ... certainly an oil importer, but it still essentially has the institutions and political structures associated with very high oil dependence, and in a sense that's all I was saying is actually trying to drive it. Similarly, you know, Brazil actually has now discovered substantial oil resources but it doesn't drive the politics of Brazil. So these translations are not simple. You're right, they'll play out in different ways in different sectors depending upon the sort of inheritance of different countries in terms of energy prices, institutions, political interests. But I think I would argue that the fundamental conception that the world's energy system and no national energy system is static, non-evolving and without cost unless you put a carbon cost on top is a completely misleading construction of the dynamics of the requirements, the necessity to evolve energy systems, to continue investment and to make strategic as well as short-term optimal choices in that evolution.

MIKE: And I couldn't help wondering as you were describing this energy divide that you saw and you painted the picture of being a very important divide, whether perhaps it's not as impervious at least in the early and transitional phases. One of the issues we would face with a carbon price here that we're likely to adopt is the incentivisation of gas, and of course, you know, that will involve infrastructure rollouts and locking in. But, of course, in the European setting there has been a lot of debate about how an associated investment in low marginal cost, high capital cost renewables have actually played out in a merit-order effect to stabilise the price rise influence of the gas route at the same time so that there's some cross-linkage between this divide which helps us get in a place where the renewables can go down the cost reduction curve.

MICHAEL: Yeah, I mean, I don't want to get, sort of, too detailed into energy markets in relation to resources. Natural gas has a very important role to play in the global energy transition, and it ... but of course it depends on where you're starting. If one's got a coal based economy it's usually the quickest next step towards reducing carbon intensity, about half the carbon intensity of coal. If you're in a situation like, you know, Scandinavia, Norway, lots of hydropower and never really done any coal for decades, gas is seen as an emitter, as part of the problem. So it is ... and in the UK now we're seeing the emergence of debate around how big is the gas bridge, how much do we place on the gas bridge, and what kind of costs will we then face to install carbon caps and storage upon gas plants when we get into the deeper levels of emission reductions.

MIKE: John?

JOHN: But I wonder, Michael, particularly in the UK situation where again you've got that political strategic overlay in terms of the UK looking at life and saying ... first, you know, one source of gas is essentially Russia. The Russians have already shown they're happy to turn off

the tap. We don't like that very much. The second major source of gas is essentially Norway. The Norwegians have in fact already got more money in their Sovereign Wealth Fund than they know what to do with and, you know, starting to see political pressures emerging in Norway to essentially constrain the rate at which it exports gas, and therefore getting worried about energy security and saying we would prefer a world in which we used, you know, less gas rather than more gas because of the political security and energy security that that provides. It's a very different conversation to the one we're used to in Australia, but my understanding is that's a significant issue in the UK.

MICHAEL: It's actually probably more significant in Germany and Poland because they are much more, sort of, umbilically tied to Russian gas. The UK has now made sufficient investment in LNG. The ... to be crude, the political establishment doesn't have an awful lot of time for people who talk about gas. Russians, ah, you know, they say, we've invested, we've got diverse. The irony is, though, it doesn't necessarily solve the problems because gas, just as much as oil, is a fuel ... particularly with LNG, is a fuel that takes, you know, a decade to develop, massive long-term investment, and hence it has these deep cyclical properties. It's all very well for the UK to have built import facilities, but what will the state of the world's gas market be in a decade? Will there have been enough investment in Australia? Probably. Has it all been snapped up by China? Probably. Have the Russians made enough investment? Probably not. So I think it has the essential characteristics that have led to a lot of volatility in the oil world, and that does worry a little bit the more informed policymakers in this space, even when they're not sort of worried about the old version of Russia turns off the tap, which frankly was always a bit of a red herring.

MIKE: Great. Well, perhaps we can open up for a broader set of questions, and I emphasise questions to any of our panel members here are short questions rather than political electioneering would be good. Thank you.

AUDIENCE: Right. Here we go. We haven't heard mention of that very nasty solution, nuclear. How do we go there? Can you expand on your thoughts of where nuclear would sit in this?

MICHAEL: Yeah. We've got three basic types of options for low carbon electricity. One is nuclear, one is CCS, and one is renewables of various sorts. My attitude is very simple, which is, you know, take any one of those off the table, it's going to get a bit more difficult and costly. Take any two of them off the table and it's going to get a lot more difficult and costly. In terms of state of technology, CCS is probably the least developed and most risky. In terms of costs and established industrial capacity to deliver, nuclear is probably ahead of the big renewable options like offshore wind energy which we're looking at in the UK. Obviously nuclear has other sorts of problems, as we've seen some of the political fallout from Fukushima. I mean, very much of the advice to the Climate Change Committee in the UK is keep all three options in play. I mean, nuclear is not the only solution but you take it away and it is harder for a substantial number of countries.

MIKE: And I know, John, you're a keen options man.

JOHN: Well, and I would agree for Australia. Australia, of course, has a slightly different issue, which is none of the institutions are in place to enable our nuclear power industry to get up and running, and we certainly argued previously that it would make a lot of sense for Australia to spend the next three or four years building those no-regrets institutions. We don't have to make a decision in the next three or four years to build a power station, but it would be nice to at least have that option in three or four years' time, which at the moment we simply do not have.

MIKE: And what's your reading of recent events of the direction of the discussion here in Australia around nuclear options, Robyn?

ROBYN: Well, the Australian public has never had an appetite for nuclear power. It's got a good appetite for selling uranium to other countries so that they can generate nuclear power, but it's going to be a very hard political battle to win. Maybe it was Neville Shute's book, *On the Beach*, written a long, long time ago, but there's been a strong anti-nuclear movement here and it seems with our abundant solar resources and other options, like possibly geothermal, wind

and wave, why would you go down that path given the risks which are never fully factored in. But that said, if ... as long as the government doesn't step in and try and underwrite it, if it leaves the full insurance costs and so forth on the industry itself, it often just turns out not to be economic.

MIKE: At the back there.

AUDIENCE: Michael, thank you. I enjoyed your presentation, found it very informative. I just wondered, I assume you're not here in Australia just to talk with us, do you have any scheduled meetings with any Australian parliamentarians, do you have any meetings scheduled with our peak industry bodies, and perhaps an interview with Andrew Bolt?

MICHAEL: Is Andrew Bolt one of your famous shock jocks?

ROBYN: Yes.

MICHAEL: Yeah, I'll give him a go.

AUDIENCE: Think Glenn Beck without the Biblical references.

MICHAEL: I've had a packed schedule with all sorts. I've perhaps not had the meetings with heavy industry that might have been ... might be quite nice and interesting. I hope one or two have turned up to this talk. You never know.

MIKE: You're not just out here to see what's going on in the colonies?

MICHAEL: See what's going on before the wedding, you know.

MIKE: Yeah, okay.

AUDIENCE: Hi. I'm Alan Lee from the United Nations Industrial Development Organisation in Beijing, China. I've got a question about the measurement reporting and verification of data that you think would be required in order to have the kind of carbon added regulation that you've suggested as a solution. What level would be required and do you think that it would be politically possible to get that level from countries such as China, given the intense political sensitivity that associates this issue in current negotiations internationally?

MICHAEL: Yeah. It's a very detailed but very important question. A lot of the international negotiations in the last two years have been sort of hung around the issue of MRVing, MRV, Monitoring, Reporting and Verification. I think it would be very difficult, to the point of impossible, to say that on all these different commodities we want a regime which will require all of the commodities that arrive on our shore to have a fully monitored, reported and verified carbon audit trail, for all kinds of reasons. What I actually think we should do is something much more incremental, and much simpler and initially much safer in terms of world trade and other things. If we take the example of cement, I think that where you start is to say ... and it is the simple one and others are, on the whole, more complicated. You say, right, well, something arrives at our border, looks like cement. You maybe do a chemical assay. You say, right, there's this much clinker in it. Must have ... with current main technology, best technology even, must have emitted at least 0.6 times CO₂ per tonne of cement. That's what you've got to buy, and you basically sit there and wait, because cement is an area where there is substantial innovation possibilities, even beyond, you know, using clinker more efficiently, there's all sorts of interesting ideas out there. Just to give an example, there are certainly folks in Tasmania been developing a technology and company selling magnesium-based cement which is actually carbon negative. It sucks the CO₂ out of the atmosphere to make the cement. It's not an industrial product yet, it's not at scale. There may be all sorts of problems, I don't know, but there's lots of interesting stuff.

So you wait until somebody comes and knocks it. So Europe sort of does this, waits until someone comes and knocks at the ball and says, hey, this is not fair. I'm not emitting 0.6 tonnes of CO₂ per tonne of cement, per tonne. I say, okay, prove it. And they have an incentive to

prove and to provide the MRV trail and you say, okay, fine, convinced, you've only got to pay 0.3 whatever it was associated with that ... that was actually associated with that product. Then you've moved into a very interesting space in terms of the fact that you have incrementally moved into a zone where there really is incentive for other countries to decarbonise stuff that's coming in in order to get below the threshold that you've set at the border, and I think that's the way we do it.

AUDIENCE: Can I ask, Michael, are you a technological optimist? I had the sense earlier on that perhaps you weren't ... you were hedging your bets a bit, but there are clearly a lot of technologies which are emerging now, the beginnings of which we are seeing can quite dramatically change the economics of the way we do things, and once they begin to change there's an enormous ...

MICHAEL: I'm a long run technological optimist, providing we get the right structures of ... structures and combinations of support and incentives. I think the human capacity to innovate is amazing. The human capacity to want to make money out of the things they've always done and have got and institutions is also amazing, and you've kind of got to be able to push the incentives.

MIKE: Yeah. I know, Robyn, you've been involved in a lot of these international governance arrangements around environmental issues and clearly there's monitoring and that is a key issue in verification and the question is a key issue in the discussions around how we get effective agreements. Have you any comments of experience?

ROBYN: Well, it's a really burning issue for the US and the current administration's made that a big issue. Of course, at Copenhagen it became a flashpoint with China and India because they said, we're not undertaking international commitments so why should we have to subject ourselves to MRV? So the developed countries led by the US responded by saying, well, if you want our money, we want to see your MRV, so China said, we don't want your money. You can give your money to the less developed cou ... less ... you know, the least developed countries, but we're not at that stage anymore. So they came up with some weasel words in the Copenhagen Accord to say let's revisit this on another day, and they're continuing to do that, and it's ... you know, it's remaining in there. In the Cancun decision, it's still a live issue and it will remain one. I mean, it is an important question. But the point that Michael made about just setting some threshold and putting the onus on firms to show that they deserve to be well below it is a very administratively simple and workable way of getting around that where you suddenly bring in the MRV trail when you need to, because you don't want to be looking at every ... the transaction costs are just huge. You have to find some ways of minimising them, and that's an eminently sensible solution I don't think the Chinese would be too worried about further down the track.

MIKE: Thank you. Take a question from up here.

AUDIENCE: Hi. Given the change in paradigm that you've described and outlined today, where should the UNFCCC go and how should they proceed in working to get internationally co-ordinated action on climate change?

MICHAEL: I think that first the ... you know, the broad description of, you know, we haven't got the kind of strong top-down regime that some hoped for and wanted. That's absolutely true. Copenhagen, Cancun was sort of a very difficult, painful process. Tremendous celebration within the UNFCCC process, UN system and more widely government diplomatic circle at the success of Cancun. I had to write an editorial for climate policy afterwards about Cancun and I found myself saying some two main things, one of which was Cancun was a real achievement. It pushed the art of the possible pretty close to the limit. It took a lot of political skill and effort to come out of Cancun. Unfortunately, that also proved that the art of the possible at the international level is totally inadequate in relation to the scale of the problem. The other thing is what did Copenhagen, Cancun actually achieve substantively? Well, it preserved the ship of an institutional structure and process for global efforts. Exactly what it has preserved in content is a bit less clear.

It is, frankly, more like an updating of the framework convention of 20 years ago to reflect the fact that the world has changed and the major emerging economies are clearly part of the dialogue problem and solution. But it certainly wasn't a successor to the Kyoto Protocol at all. I mean, it didn't have any legally binding anything, really, and I am, frankly, not persuaded by what has been very fashionable in some academic circles that, yeah, that's great, this top-down stuff was always unrealistic. It was never going to go anywhere. Bottom-up is where it's at. Let's have a thousand flowers bloom and countries can now just ... free to do their own thing and solve the problem, and I think that's bonkers. I've seen at very close quarters in Europe a definitive battle around the European emissions trading scheme was around the attempts by a number of countries to give out too many allowances for phase two of the scheme. It was a ferocious political battle and in the end the European Commissioners, the policemen, won that battle because Europe had ratified the Kyoto Protocol, Europe had an international legal obligation that had been written into European law for its policies to be compliant with the Kyoto caps.

If we had not had the Kyoto Protocol and if it had not been rooted in International Law, Europe would not have the emissions trading scheme and we would not have a significant carbon price. So these institutions matter for various levels and reasons of governance. Where does that lead me? And, sorry, this is a bit of a long answer. I think we're on a long road of reconstruction. We have a ship. Our problem is it doesn't have a motor, really. Where does that motor come from? I think the motor has to come from the construction of the coalition of low-carbon economies that I had referred to in my talk. And I think once that has acquired a substance and the political mass of an alliance, certainly involving EU, some of the major ... EU, Brazil, some of the major emerging economies, hopefully some other industrialised economies, then I think you change the political dynamics that you can then bring back into the UNFCCC.

MIKE: Thank you. I'll take a question back there.

AUDIENCE: Thanks for an interesting talk. I wonder if you could expand on your last point about getting energy exporting nations to the table. What's in it for them, or us, and what will get us to the table?

MICHAEL: I think there's probably many levels of answers to that, some of which will be quite deep about national self-image and where do you want to be. There is a much cruder answer as well, which is do you really want the rules of the low-carbon coalition to be purely written by importers? There are reasons why people join institutional processes even when, at first glance, you know, their game is not obvious and it's usually because they want to be at the table when the rules are made and the deals are done.

AUDIENCE: So we have to wait for the importers to become powerful and set those rules or is there ..?

MICHAEL: Well, I mean, generally, the earlier one is at the table, the more influence you have in shaping the rules.

MIKE: Where does the country want to be? Our Prime Minister made a statement about that, Robyn?

MICHAEL: I mean, I'd add to that, I guess, the point I made earlier which is that there's a strategic element to this in terms of the country worrying about a future not just where it doesn't get to write the rules, but where one of the consequences of all of that is you suddenly wind up in a very, very unattractive position, and particularly if you can see a world in which there's going to be a whole bunch of border import adjustments, an extremely unattractive world.

ROBYN: If I could just add to that. The US, of course, is a huge sticking point in this whole process, and for a long time, you know, the majority of folk in Congress have been saying, why should we go first? What's in it for us? You know, if China's not ... it's a free kick to China. It's akin to unilateral disarmament and we don't do that. But now there's just a few voices in Congress who are saying, do you know, I think China's going to win the green tech race. Why aren't we first? So they've been saying, why should we be first, for a long time, but now they're

saying, why aren't we first? And the other ... that could turn things around in the US, and the other thing that gives me some modest optimism is that the US military is now starting to aggressively innovate. They've got a fleet of aircraft called the Raptor 3 that now fly on a biofuel made from a mustard seed operate perfectly and efficiently. Because they are the biggest users of oil in the world. If they don't innovate, they could lose their strategic advantage. They need battlefield readiness, they need another transport fuel, and, you know, one of the biggest solar rays in the US are in a military town, so they're starting to move and they'll move way ahead of Congress. So maybe you'll have ... drawing out the competitive instinct of Americans, maybe that's what will begin to turn them around.

MICHAEL: I mean, let me just add to that 'cause I didn't want to ... there's a slight risk in this, as always, of painting a slightly simplistic picture. The US is a very interesting country, it's a very innovative country. Absolutely, as you say, there are actually large and powerful constituencies in the US that are horrified at what happened last year, and they include much of the military establishment, because, frankly, for several years now, they have been warning that climate change is a major threat multiplier. It can help to dist ... I mean, the US itself you can argue is a big area, north/south and east/west and can withstand a lot of climate change, but, you know, for a country that still sees itself to have an important role in the global policemen, the potential of climate to exacerbate other things and the potential for the US to be blamed and to turn, you know, effectively, acts of God, to start to be blamed as acts of the big emitters, is not a comfortable place for US security in the 21st century. So you're absolutely right. The US military is actually quite worried about this issue, and I expect it's not just they want battle-readiness with biofuels. They actually want to kind of contribute to what you might also ... and what we might see emerging in the US is more of a sort of privatised or semi-privatised multi-institutional response to try and do stuff in ... to get around the paralysis of Congress.

AUDIENCE: And it's quite nice to see the name of the poor mustard seed plant be reclaimed in the military space in official purposes.

MIKE: Sorry, one question over here and perhaps one more after that.

AUDIENCE: Just a question for John. If developing countries adopt a carbon price, and it seems the likelihood of that is that carbon intensive industries might go to developing countries, even with a tariff, what incentive is created for them to become less carbon intensive? If the developing country retains the tariff then they may have more pressing things to spend their money on. If the developed country retains a tariff, well, that really gives nothing to the developing country.

JOHN: Well, I think this is where it feeds into Robyn's suggestion around ... and I suspect from a WTO point of view, you would have to do this. If a developing country puts on an export tariff, then you will be obliged as the importing country to take that into account. So, in effect, the tax revenue gets captured by the exporter, so by the developing country, and, you know, it's not impossible for them to set up those tariffs so they're actually selective, you know. If it's going to a country with a carbon price, then they put on the export tariff and otherwise they don't. That said, and I think this is one of the powers of the way that Michael's thinking about this, we shouldn't imagine that China is ... well, it's clear, China is already now an energy importing country, and also it's worth thinking about what are their incentives and how do they think about the world, and Cameron Hepburn's written I think a lovely paper, essentially arguing that China's self-interest is ... they are a quarter of the world's population, therefore they have a very vested interest and they're not being too much ... climate change, you know, in essence, inside their borders, more of the people ... they've got more of the people affected than many other people, and at the same time the Chinese economy and what happens to it is probably, you know, one of the major swing factors in terms of global emissions.

I mean, as Michael's charts show, you know, if Western countries kind of bring down their emissions a bit, well, that's nice in terms of the overall area. If China and a couple of other developing countries move their emissions up, you know, towards the developed country averages, you know, that will totally dominate the graph. And so the argument is essentially that China is in a position where it's, you know, more effective than just about anybody else, simply because they've got more of the world's population, and they've got more control over the

outcome than many other places internally because that's the swing factor, and therefore it's in China's self-interest to ensure that its own emissions don't go up that fast. And if you then ... Cameron actually takes this a step further by arguing, okay, so if that was your world view, totally selfish world view, as China, what would you do? And the answer is, well, you'd try and provoke a world technology race for low carbon emissions technology, and you would be trying to promote a world in which, say, people like the Americans were really worried that you, China, were going to get there first, which is not a bad description of the world we live in.

MIKE: Thanks very much. Just one more question, one final question before we wrap up, just here. Yeah.

AUDIENCE: Thanks very much. Very rich contributions from everyone, in particular Michael. Look, it's been really interesting following the discussion. It seems to have moved away from a very simple binary of energy importers and energy exporters through recognising the complexity that some countries import oil and export a whole range of other energy forms, coal and gas. The United States has been an energy importer and oil importer, and oil import dependent for the last 40 years. It's very clear that that binary has broken down. As the discussions developed, it seems to me that the security narrative has become stronger, and you've all, in different ways, started to draw on different versions of that security narrative. In terms of energy security, for example Russia's threat in terms of gas supplies, the OECD crisis ... the OPEC crisis in the '70s in terms of the oil, oil crisis, having driven certain European countries towards a much more proactive energy posture, France, for example, and Germany. And then also the security narrative that Robyn was raising in terms of the mixture of climate and straight out military security threats. So to what extent do you think security is actually a very prominent driver of these changes, rather than price incentives, rather than moral incentives, and so on?

MICHAEL: I mean, I think there is indeed ... on Monday I gave a talk at the Grattan ... the Lowy Institute where I put a little bit of stuff at the beginning about my sense that there are actually, you know, almost three domains of just basic conception about this issue, of which the first tier was actually a very laid back, well, sort of popular, populist, I don't really see it around me, I'm busy, I'm not convinced climate change is all that real or I'm not that worried, but, anyway, I'm too busy to think. The sort of don't know/don't care kind of position, which can, to some extent, arguably match but I'll do energy efficiency 'cause it's actually quite good for me, and there's a sort of read across there, and then there's a zone where you accept climate change is real, it's happening, it's going to have costs, and as a sort of economist domain, I'd like to know how big the costs would be, I would like to evaluate those costs, I would like to know what the trade-off is and what benefits I get by cutting emissions and make a sort of optimal trade-off and have a carbon price reflecting that optimal trade-off, with classical economists' construction of the problem.

We have a big problem in the economic solution when we've tried to measure the social cost of carbon, you get huge debates about how you actually value stuff over time, over generations, how you actually value impact across different countries and different income levels and welfare, which as well ... and that's before you've done the scientific uncertainty, and you sort of conclude the carbon cost is probably ... the social cost of damages is somewhere like ... somewhere between 10 and 1,000, and the upper end of that is partly reflecting just you're starting to push at the boundaries where you get to worry about social stability, you get to worry about initially in weak regions, vulnerable states, the potential of that to spill over and ultimately, you know, when you look at the more scary scenarios of the scientific literature and the enormous inertia and you look at, you know whether it's the thermohaline system collapsing, whether it's Amazonian Basin collapsing, whether it's monsoon systems inverting, or some of the feedbacks, you know, methane hydrates emitting more, you say, well, hang on, the whole system could be at risk. And one of the things that I think is going on here is economics only works within a certain level of domain, and basically it's defined by assuming that you have a stable institutional structure and regulatory framework within which costs, benefits, property value, etc, really mean something, if you have real faith them. If that starts to collapse you're in the domain of security and you're in the domain of long-term strategic concerns. The primary responsibility of governments is not to optimise, it is to give security to their citizens, and I absolutely think that there is more and more securitisation of the climate change issue going on in the way that some governments and constituents are thinking about it.

MIKE: Well, thank you very much, Michael. That's a very nice point to end on and it brings me back to my safe domain, the global perspective, methane leaking out of the earth, as a geologist. Sitting here as a geologist listening to this discussion and the questions, it has been wonderful to see the engaged discussion, the polite discussion, the questioning and the rich understanding that Michael, in particular, but also Robyn and John and brought to this. This is a debate as it should be carried out in our society, and one I think that we're beginning to mature towards. It's clear we have a long way to go. It's clear we can learn a lot from how the debate has unfolded, particularly in the European realm, and it has been a wonderful privilege to have you here, Michael. I would like to thank you on behalf of both the Grattan Institute and Melbourne University's Energy Research Institute for taking the time to come and talk with us. Thank you very much.

MICHAEL: Thank you.

AUDIO: This has been a podcast from Grattan Institute. Want to hear more? Check out our website, www.grattan.edu.au.

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