

Speech Topic: Garnaut Climate Change
Review – Update 2011
Compere: Tony Windsor, Member for New
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Speakers: Professor Ross Garnaut
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Transcript:

TONY WINDSOR: Thank you for taking the time to come here tonight. Actually I wasn't to be the Chairman but the Chairman has been called to a bereavement, so I'll step in and chair the meeting. I do thank you for the good attendance that's here tonight.

It's an issue that's created a lot of debate and I think one of the things that the climate change debate should, in fact, do is be a legitimate debate about substantive issues.

Tonight, we're very fortunate to have with us Professor Ross Garnaut, who's been very involved in a whole range of issues in and out of the political sphere for many, many years. Ross and I were fortunate this afternoon to spend some time at Tim and Karen Wright's property, west of Uralla.

Even though I've been there before, the group that got together there today - I think Ross would agree - was a very, very informative session in terms of the various grazing technologies that are being embraced in parts of the northern tablelands. One of the things that's come across - and I don't intend to make a speech - but one of the things that's come across very clearly, I think, in terms of this total debate since climate change or global warming has become a little bit of a buzz word is the significance of soil having suddenly re-emerged as being important.

I think we went through a few decades where soil science - the value of soil in terms of health, the value of soil in terms of what it could do in the environment - was essentially neglected because it was there and people grew plants and we had plenty of food.

I think one of the very great positives that's come out of the debate in the last few years, is that suddenly soil has become important. For a number of reasons obviously, for the sustainability of the globe, the various issues in terms of food security are important. The capacity for Australia to be apart of a contribution to global food supply. Various issues in relation to drought that had occurred right across major parts of Australia.

This issue of soil has also re-invigorated some of the issues in terms of humus and organic matter and soil carbon and what that actually means. Some people saw it early in the piece, a few years back, as some sort of new source of income in terms of entering some trading arrangements.

There were debates at that time about the capacity for soils to hold onto carbon at depth and the potential to lose carbon during very dry periods of times, those sorts of issues were out there in the public debate. Some of those issues we discussed this afternoon, very importantly, in my view. Some of the changes in technology, not only in the grazing sector but also within the farming sector and I personally have a piece of land that has been under what's called a no till environment since 1977 - probably one of the longest pieces of land that's been continuously cropped but not cultivated for something like 34 years. The issues that relate to the health of that particular piece of soil are quite significant.

So I think in terms of regional Australia, there are a number of issues that are out there. One is what's in it for us, if in fact, there is some sort of pricing mechanism placed on carbon emissions. Bearing in mind that this issue of carbon emissions isn't only about carbon, it's about nitrous oxide, methane and other greenhouse gases. They're expressed in carbon equivalence, or carbon dioxide equivalence. What's in it for regional Australia?

One of the reasons - and most people would be aware in this room, I guess - that when the carbon pollution reduction scheme was brought up on the last occasion, I did not support it. Now I don't want to get into the dynamics of all of that, but I think there are some significant issues that we need to address in terms of what are the opportunities under various structures that could be put in place, if in fact, some sort of price on carbon was applied.

What would it mean for regional Australia in relation to the renewable energy projects that could evolve, whether they be wind, solar, geothermal, biomass to biofuel. All of those things would occur in some country location or others and then in some cases they might be value adding to some of the production that we already have.

Also very importantly that as most emissions trading schemes are structured the reason for the scheme is to sort of encourage certain activities. Part of the structure, normally - and not assuming that will necessarily be the case with this one - but would be that there's a receipt of income. That income is required to be spent in certain areas, it may well be that it would have to be used to compensate electricity increases in the community.

It may well be - and this is one of the reasons that I've stayed very much in this debate rather than just walking away from it and using a few sort of words that try and create an atmosphere of fear - it may

well be that there is an income stream that could be used to encourage a lot of the agricultural pursuits that this area and other areas are famous for.

Some of those things like we saw this afternoon. Some of the technological practices that occur in the cropping sector where drought isn't completely ruled out but it is minimised in terms of its impact on those who utilise certain practices.

It may well mean that those who sequester carbon - and Ross, taking some of your thunder, I guess - those who sequester carbon may be recompensed for doing so. It may be that a lot of the research and development that Australian agriculture or the food sector has been crying out for could be derived from some of that income stream.

It may well be that a lot of the research that needs to be done, in terms of renewable energy advancement, could in fact be financed through an income stream back into the land use or landscape sector. It may well mean that a whole range of biodiversity credits could be put together.

So I'd like tonight to be about the whole issue of, essentially, climate change. What can we do about it? Should we be doing something about it? Is it important? What's happening internationally? Is that important? Should we be the part of any international pursuits? If so, why? What are the potential benefits or otherwise for regional Australians or the nation and what are the potential outcomes of doing nothing?

Now most of us in this room will probably be dead by the time the adjudication takes place on who was right and who was wrong. But one of the things that concerns me as an individual is that I actually get a vote on this and it isn't just about - in my mind anyway - it isn't just about the next few years. It could be potentially about the next century and further down the track.

I think we're all - we should have a responsibility to actually investigate some of the issues that are out there in terms of the future of the planet and the impact that mankind is having on it. So I take the debate seriously. I think those people who have ruled themselves out of this particular debate have done so in a negligent sense.

I think this is a debate - whether you live in the country or you live in the city or you live in the world - that we should be a part of. It's also - and I'll finish in a minute, Ross - also, from my point of view, a debate that has to achieve something if in fact we do something.

I'm not interested in being part of something that does nothing, but I am interested in being a part of something that does something. And in terms of, I guess, the pub test of my vote, that will be one of the things that I'll be looking very closely at.

A person like Ross Garnaut is a very important ingredient in that. The Productivity Commission is a very important ingredient in that in relation to the implicit pricing of not only the emission trading schemes that are globally existing - and I think there's about 36 of them - but also the implicit pricing of various policies in various countries that relates to the carbon price.

I think most people would recognise now that if we agree that the nation or the globe - probably a better way of putting it - wants to do something, probably the most efficient and least costly method of doing that is to price the arrangement and put it into the marketplace. Others would take issue with that and do it in different fashions. Maybe a combination of the two is probably one of the eventual outcomes.

I do welcome you, Ross. I first got to know Ross Garnaut, and I spoke about it this afternoon, at that memorable event, the 2020 Summit, that the previous prime minister, Kevin Rudd, put together and Ross Garnaut - the group that I wanted to be on was the impact of climate change, I think, mainly on agriculture but I think it was a bit broader than that - and Ross was on that group as well. Our chief negotiator in Copenhagen, Penny Wong, was the chair of that particular group.

I think that's about four years ago now but even at that stage we were talking about soil, carbon, measurement, loss, drought, those sorts of issues. So I'm very pleased that he's been able to be here, not only for tonight, but for today as well and sharing the table in terms of this - what's called the Multi-Party Climate Change Committee - has been very informative to me in terms of a lot of the issues that are out there.

So I do welcome Ross. I won't go through all of the things that you've been engaged in, Ross. Ross Garnaut is currently Vice Chancellor's Fellow at the University of Melbourne. He was involved with the Australian Centre for Agricultural Research for many years and also with the International Food Policy Research Institute that was based in Washington. He was also the Ambassador to China and a whole range of other political, quasi-political and policy issues and has been one of the very strong advocates of a price on carbon, but also one who's been able to embrace with the scientific community as to the various scientific information that's out there.

So without further ado - and after Ross has spoken, he welcomes questions. We don't want statements, if you don't mind. Ross is the speaker tonight but if there are questions on how this will impact on the price of particular inputs into various arrangements, bearing in mind that there is nothing there as yet. So there's an assumption that there will be some sort of pricing mechanism whether it will be a tax or a trading scheme or something else. So base the questions on the scenario that you may think will exist.

I welcome your presence in my old university, Professor Ross Garnaut.

ROSS GARNAUT: Thanks, Tony. Very good to be here at the University of New England and it's a university with which I've had a lot of indirect connection. The economics department that I headed for many years at the Australian National University had lots of links with agricultural economics and development economics here at UNE. This was recognised as a major centre for work in those areas.

I succeeded John Dillon as chairman of the Australian Centre for International Agricultural Research, so I'm very glad to be here and I've got a lot more connections with UNE than that.

As Tony mentioned, we had a great afternoon this afternoon out at the property, Lana, looking at successful carbon sequestration in action and talking to other farmers and experts in the region who've found that farming practices that incidentally sequester carbon and therefore contribute to mitigation of climate change have been very useful in preserving moisture in soils: good drought protection in encouraging nutrients which obviate the need for intensive use of chemical fertilisers as a whole range of productivity and profitability benefit from farm practices that incidentally sequester carbon. Capture carbon dioxide from air and turn it into biological carbon and take it out of the atmosphere, out of harm's way. Those questions of biosequestration are going to be very important in Australia's management of its response to global warming.

This new area of innovation in Australia - I say it's new although for twenty or thirty years there have been people working in the area - but it's become much more important in the last ten or fifteen years looking at the structure of soils, carbon in soils is really part of a long Australian tradition of using science and technology to improve profitability and sustainability in farming. Farming was hard in this country. You couldn't simply take what was done in the countries that most of our forebears came from. There had to be major adaptation to local conditions. You needed science and technology for that. Successful Australian farming from a very early stage was based on clever application of science and technology.

That's the past, it's going to be the future as well, and our success in application of science and technology will be our main asset as we go through another transformation. The transformation that's going to be helpful to Australia's climate change mitigation is also going to be necessary to economise on use of fertilisers whose chemical sources or geological sources are becoming more and more scarce, so it's going to become much more expensive, for example, phosphate fertilisers. One of the challenges of climate change itself is going to be a more variable climate, probably more extreme droughts as well as more extreme high rainfall episodes and managing that is going to be helped by systems that are sensitive to carbon in soils.

I'm not a climate scientist, I'm an economist, but to do my work to complete the commission that I was given four years ago originally to

do my climate change review that I have to the state premiers and to Prime Minister Rudd in September 2008, I had to familiarise myself with the climate science. After a lot of reading, a lot of interaction with the scientific community in Australia and abroad, including deliberately going out to try to understand so-called sceptical views - I came to the view then that on a balance of probabilities the basic propositions of the mainstream science were correct. If they were correct, the consequences of that for all aspects of our economy, for our way of life, if you like, for our civilisation were so substantial that we would be reckless if we did not take major steps to insure ourselves against that.

There's now another three years of evidence and scientific analysis since that work. I presented an update of the science in a paper that I presented in Hobart about a month ago - that's on the web site of my review, garnautreview.org.au - and that update led me to a stronger conclusion I think that, as someone from outside the climate science looking intelligently at what the specialist climate science is saying, what all the academies of science in all of the countries of scientific achievement around the world are saying, one comes to - well I came to the view that the basic propositions of the mainstream science have been established beyond reasonable doubt.

One thing that is clear is that there's no doubt at all about the reality of the warming trend, globally and in Australia. Every decade in the last half a dozen decades has been significantly warmer than the one before. That is continuing.

Other manifestations of warming, like melting of glacial areas, are clearly observable. Sea level rises tracking near the upper end of the range of possibilities that the scientists presented at the Intergovernmental Panel on Climate Change identified the warming that's already taken place has increased average temperatures over about the past century as up towards a degree. That's already having significant effects on many things, but that's just the beginning.

If there were no policy efforts to break the nexus between economic growth and the emissions of greenhouse gases then we could expect large increases in temperature through this century.

The international community at Copenhagen and Cancun in the last two Decembers, through the United Nations Framework Convention on Climate Change, has committed - has agreed - to work together to hold - to try to hold the increase in greenhouse gases in the atmosphere to a level that gives us a reasonable chance of holding temperature increases from pre-industrial levels to about two degrees Celsius.

Even that would mean substantial changes, substantial - the science says - that would involve substantial increases in extreme weather events; a substantial increase - continued increases, in sea level affecting coastal areas; major changes in wind patterns affecting

precipitation which the climate models - the climate scientists - find difficult to predict precisely and in these latitudes where we are in the northern tablelands particularly difficult to predict precisely.

In southern Australia the climate models are saying there'll be - there's very likely to be a shift south in weather patterns - in wind patterns - with warming which will take out into the Southern Ocean a lot of the precipitation that brings the winter rain that drives the cropping in southern Australia. That will create a very large difficulty. Here where you've got a wider range of sources of precipitation the outcome will not be so clear. At very least the warming will lead to greater evaporation so the same amount of rain won't go as far in driving plant growth, and runoff will shrink proportionally much more than rainfall. So there'll be less water in creeks and rivers ending up in places available for irrigation.

So Australian farming will be in for quite major adaptation requirements, even if the world succeeds in holding temperature increases to two degrees centigrade. If the world doesn't succeed in that, if we failed altogether, the upper limits of temperature increase are very severe indeed.

That's why it would be reckless of us not to make a major effort to do something about the problem. We can't do it alone. What matters is the amount of greenhouse gases in the atmosphere, whatever country they come from, and I've emphasised in my work the importance of our playing our proportionate part and not more but certainly not less than our proportionate part as a developed country.

The adaptation that's going to be required, even with two degrees in agriculture is going to mean big changes in optimal planting and harvesting times, changes in the types of crops and cultivars, changes in the animal types that do well. That is going to require a lot of - application of a lot of science and technology, a lot of clever work for us to do well with those changes.

It's going to be very hard for the world to achieve anything like that degree of mitigation and every step upwards from two degrees to three, three to four, makes things harder still. There's no point at which you can say things are so bad that one should give up because every further degree of warming will have very large additional consequences. So even if we don't succeed in our most ambitious aims, it's still going to be worth doing something about it.

My original review, which I gave to the prime minister and state premiers on the thirtieth of September in 2008, concluded that Australia is the most vulnerable of all the developed countries. It's got the most to lose from unmitigated or weakly mitigated climate change. That's partly because we're already a country of climate extremes, so increased variability can have a greater impact here than elsewhere. Where a lot of - and a lot of our agriculture is already in areas where

we're approaching the limits of climatic conditions in which agriculture is common around the world. If it gets a few degrees hotter in the south-east of Britain they can start using wheat varieties that we developed in New England, but if it gets a few degrees hotter in Australia in the wheat-growing areas, there aren't other wheat-growing countries that we can go to, to take the wheat varieties that would be suitable for that climate.

So agriculture is going to be especially challenged in Australia and Australia is a country in which agriculture remains more important than in most - in nearly all other developed countries. Australia's also very vulnerable because we live in a region of developing countries. For a number of reasons developing countries are going to be especially vulnerable to climate change and their problems - problems of developing countries in our neighbourhood, quickly become our problems. Australia is the only developed country whose trading partners are mainly developing countries and again, disruption of economic activity in Asia would have significant effects on our terms of trade.

So we would be exceptionally damaged by a failure of global mitigation, but we would be - we are very well placed to do well in a world of effective global mitigation if the world succeeds in putting in place arrangements that reduce our greenhouse gas emissions. Then Australia has, amongst developed countries, unique resources for success in that world.

Just taking agriculture, any effective global mitigation effort, is going to make energy more expensive as we turn away from the cheapest of fuels, coal-based and other fossil fuel based. Our livestock industries are much less energy intensive than the livestock industries of our competitors in North America, Japan, Korea, China and Europe, where, for example, animals are warmed artificially through the cold winter months and where the feedstock of animals tends to be much more energy intensive than our livestock which still has a major grass-fed component.

When you look at alternative energy sources, Australia per capita is the world's super power amongst developed countries. So, whatever the low emissions energy sources you're looking at, we're especially well-endowed, not only per capita, but absolutely, we've got the world's largest resources of uranium oxide and high grade uranium oxide, which is important for low emissions nuclear power.

We've got, amongst developed countries, the world's greatest resources, absolutely and of course per capita by an even larger amount, in solar power. When I was working on the original report the leader of the German solar energy programs came to have a chat with me in my office. I was then at ANU before I left for Melbourne. He'd just been around Australia - Germany makes much larger use of solar power than we do, as most of you are probably aware of.

He was slightly distressed after his look around solar energy in Australia and he said: *well, in Australia, the worst place I've been able to find for solar energy, the place where cloud cover is most common is the west coast of Tasmania, but that is better for solar power than the best place in Germany.* Well, despite that natural disadvantage they've got quite a large solar energy program.

Wind power - the south coast of Australia and the west coast of Tasmania have some of the highest quality wind resources in the world. Biomass - exceptional opportunities here if you just look at the areas of woodland per capita, they're far higher in Australia than anywhere else in the world.

Biofuels – biofuels are a problematic source of alternative fuels. We've seen from the experience of Europe and North America that if you mandate the use of biofuels as a source of transport fuel, for example, as they have in Europe and the United States, then that artificially pushes land from production of food into production of biofuels and that's one of the causes of rising food prices in the world in the twenty-first century.

That won't happen if you use alternative sources of materials for biofuels and there are some, a lot are under-developed, but sources that don't utilise land that is valuable for food. Australia happens to have exceptional opportunities in those areas for alternative sources of biofuels that don't compete with land - don't compete for food for use of land.

One of those happens to be the humble algae, probably not so important just around here, but algae needs a saline environment and lots of sun. Lots of places in Australia have that. Also marine energy, tidal and wave power, Australian resources are exceptional.

Almost - in most parts of the world one very important transitional fuel between coal and eventual reliance on near-zero emissions energy technologies will be natural gas, which has only half the emissions of black coal, much less than half the emissions of Victorian brown coal and Australia's very richly endowed with gas, both natural and coal bed methane. I know around here it's not universal acclaim of the coal bed methane but it is an important transitional energy source with much lower emissions than coal.

So Australia has done very well in a world in which energy has come mainly from fossil fuels, but we'll do very well in a world in which energy is coming from alternative sources.

Now Australia's advantages in this world of low emissions technologies, of successful mitigation, are concentrated in rural areas. So virtually all of the low emissions energy technologies that I mention have their natural homes in rural and provincial Australia - they're natural industries for rural and provincial in Australia.

The biggest of all will be the opportunities of carbon sequestration through biological processes in soils, in pastures, in trees, in woodlands and forests. In my original report in 2008 I devoted a chapter, Chapter 22, to land-based sequestration. The state of the research at that time meant that that was highly speculative and it was meant to get people talking and thinking about it and to inspire other research. Well, it did have that affect and there's been a lot of solid research on the opportunities since then by the CSIRO in the universities and elsewhere.

One very thorough study by the CSIRO - detailed study of biosequestration opportunities in Queensland. I was able in my update of the work on land-based mitigation - my update paper number four - to review a lot of this work and that confirmed a much more solid base than what I talked about speculatively back in 2008.

The potential for mitigation, of drawing carbon from the atmosphere and storing it through these biological processes, storing it in soils and pastures and trees, is very large. The technical potential for annual increases in carbon stored in this way is potentially as large as Australia's total emissions.

Technical potential is not realisable economic opportunities for all the reasons that we understand very well and there is uncertainty about how much we would actually generate commercially. We'll only know that when we put the incentive structure in place, and thousands of farm businesses respond to those opportunities.

The right incentive structure is for a farmer or land owner who sequesters carbon through these natural processes to be rewarded by as much - per tonne of carbon dioxide equivalent - as you're taxing those who emit carbon elsewhere. So if the price of carbon or carbon dioxide emissions within a carbon pricing scheme - the price of which coal combustion is taxed, for example, is between twenty and thirty dollars as I've recommended in one of my papers - say it was twenty-five dollars then per tonne of carbon dioxide equivalent, then the right price to pay for sequestration in the soils or otherwise through biological processes, is twenty-five tonnes of carbon dioxide equivalent. That's - for those of you who know your biochemistry - that's much more than twenty-five dollars a tonne of carbon. It's the molecular weight of carbon dioxide divided by the atomic weight of carbon, I think forty-four on twelve, times the twenty-five dollars. It would be a very substantial incentive.

Now that incentive comes on top of all of the incentives that are there through good farm management for encouraging growth of carbon in soils. It comes on top of all the economic factors and farm management factors that were shown to Tony and I this afternoon at a property up past Uralla.

Now, the idea of paying for sequestration that was going to take place on farms anyway has been a bit controversial. In the Government's initial carbon farming initiative the proposal was that you would only get credits, carbon credits, for sequestration that was in addition to what you would have done for financial reasons anyway. So that if there were economic reasons for doing the sequestering you wouldn't be able to claim carbon credits.

I argued in my paper that this wasn't a logical requirement. If there is sequestration you'll get more of it if you provide a proper incentive for it and it's no less sequestration if some farmers would have done it anyway. It's also a very difficult thing to police, very difficult to actually assess what would have been done in the absence of an incentive. So I recommended the removal of the financial additionality requirement.

I also recommended that there should be a direct link between the carbon pricing scheme and the farm-based biosequestration so that farmers could rely upon getting true value for their credits – twenty-five dollars per tonne of carbon or whatever it turns out to be.

Well the second of those questions has yet to be addressed as a matter of policy by the Government or by the Multi-Party Committee. The Government has already amended its proposal for carbon farming to remove the financial additionality requirements. So that's one step where my recommendations have already been influential.

One very important question is what is Australia's part in a global effort and there aren't many Australians I know who accept the reality of this, that the world is warming - the fact you can't look at the statistical realities without accepting that, accept the scientific evidence of a human imprint, accept that without mitigation the damage to Australia will be very large - but say well, what matters is the total amount of emissions in the world so that there's no point in Australia acting because the rest of the world isn't doing anything. Well if the rest of the world wasn't do anything that would be quite true.

I think I heard Tony give an analogy if all the lemmings of humanity are running towards the cliff and are going to fall over it, then we might as well just be one of the lemmings that enjoys the last run as humanity falls over the cliff. That would be a reasonable thing to say. We might as well enjoy the last few generations of human civilisation before humanity falls over the cliff.

Fortunately that's not the reality. Europe's doing a lot. Other developed countries are doing a lot. Japan's doing a lot, Korea's doing a lot. There's been a lot of focus in Australia on whether the United States and China, the two biggest emitters in the world, China the biggest and the US the second biggest, are doing anything.

Incidentally while China and the US are absolutely much bigger emitters than us, our per capita emissions are much higher than either

of them, about four times as high as China and are very substantially higher than the United States.

Well, ours are growing very rapidly, even with the mitigation factors that are - policies - that are already in place, the renewable energy targets and various other measures, the estimate that our emissions will be twenty-four per cent higher by 2020 than they were in 2000. So to reach a target of five per cent which is the bipartisan unconditional target of both the Government and Opposition to reduce our emissions by five per cent in 2020 below 2000 levels will require a very large change of trend.

That would still look to the rest of the world a rather meagre effort compared with what other developed countries are doing. People say the United States is not doing much but they've got a target of reducing 2020 emissions by seventeen per cent from 2005 levels. If you convert it into our comparison with 2000 levels, it's a sixteen per cent reduction. Well President Obama and his administration are very serious about this and made the commitment at Copenhagen and Cancun. He would have liked to have introduced an emissions trading scheme to achieve this outcome in the lowest possible cost way.

They've been - it's quite clear that in the current state of the Congress, certainly in this Congress in the next couple of years they will not be able to do that and so they are very committed to reaching that objective through other ways. They're doing it through federal regulation, they're regulating emissions in cars, in appliances, in buildings, they're putting very strict restrictions on the emissions from power generation not allowing operation of plants that don't meet those. They're giving huge subsidies to various renewable energies and in energy saving activities.

It seems to me that they are well placed to meet their target which is a much more ambitious target than the target that we're equivocating and arguing about.

In China which I know very well, I keep closely in touch with it, there's been a sea-change in attitudes to climate change mitigation in the last couple of years. You could honestly and accurately have said three years ago that China wasn't doing anything. China, like other developing countries at that time, say: *well the developed world has caused the problem that we're in now. Our per capita emissions are very small compared with Australia, the United States, Canada.*

I pointed out in my review that that might be true. It might be unfair for developing countries at such an early stage of development to have to accept major constraints but the brutal reality was that we would not solve the global problem unless the big developing countries accept a major constraint. Well China has accepted major constraints.

Its commitment to reduce the emissions intensity of its economic output by forty to forty-five per cent by 2020 is a very substantial change in trend from what they were doing. As part of that they've had by far the world's biggest hydroelectric program, by far the world's largest solar program, by far the world's largest wind energy program, by far the world's largest energy efficiency program, by far the world's largest nuclear program.

The nuclear program was shaping up to be even more important in future than current plans anticipate because they were looking forward to those big industrial cities of coastal China being able to generate nuclear energy as cheaply as coal-based energy within a few years.

I had lunch with the top Chinese official in charge of their energy and environmental programs just a couple of weeks ago and he made it clear that they were reviewing future programs in the light of the unhappy experience at Fukushima. That doesn't mean that they won't commit themselves again to very heavy nuclear commitments but they want to understand what went wrong in Japan and make sure that they've got that covered before they go on with other programs.

The basic point is that we are in no risk whatsoever of getting ahead of the rest of the world. There's an anxiety in Australia that if we introduce carbon pricing then - and aim for a target with carbon pricing of five per cent reduction in emissions by 2020 we'll be getting out in front of the rest of the world. We can relax. There's no chance of that whatsoever.

There is a danger of us lagging seriously behind and if one developed country doesn't pull its weight that does have an effect on other countries. Just like here we've got a big debate about whether we should do something and people who don't want to do anything are always able to point to someone that used to point to China; now they'll point to Tanzania or somewhere that's not doing anything.

Tanzania actually is doing a little bit but you've got the same debates in every country. In a country like India whose per capita emissions are one-twenty-fifth of Australia's, people there do say: *well this very rich country with by far the highest per capita emissions in the world with a per capita income twenty per cent higher than the United States, that's us, is having a debate about whether they'll do anything at all. Now we've got one-twenty-fifth of the emissions per capita of Australia, why should we do it?*

Even in America the American ambassador to Australia on several occasions has said to me, *look I really hope the process of which you're a part can generate some results. Don't underestimate how that will feed back into what President Obama is trying to do in the United States.* It will be positive, it will be helpful to America if Australia does something.

Other countries are doing things in different ways. Europe - the Europeans have got emissions trading schemes covering half-a-billion people; approximately half of the rich people in the world. In America and China they're doing it through regulation while the American administration would prefer to be doing it through carbon pricing, through an emissions trading scheme.

I talked through this at some length with Steven Chu, the Cabinet Member for Energy, President Obama's Secretary for Energy, a Nobel Prize winner and he said *we're going to reach those targets. I would have liked to have done it in a way that imposed the minimum possible burden on the American people, on American business but that's been blocked so now we'll have to do it in an expensive way.* If you like, the American Congress has shot America in the foot.

We can reach our targets in a cheaper way through carbon pricing. It doesn't make very much sense for us to say, *okay America, we're going to keep shooting ourselves in the foot until you stop shooting yourself in the foot.* I think that's the appropriate analogy.

Economy wide carbon pricing is - has to be the centrepiece of a low cost way of reducing emissions. It can't be the only component of a successful low cost effort. There needs to be specific support especially for innovation, for research, development and commercialisation of the new technologies that will reduce the cost of adjustment to the carbon price. Rural Australia's got a lot to gain from that and I've discussed that in my paper on innovation. I've said a lot in my electricity paper about specific questions related to the electricity sector; I won't go over that now but I'm happy to answer questions about it.

So in conclusion the science tells us very clearly, the mainstream science, the real climate science, the science that's supported by the Academy of Science of Australia, the Academy of Science of the United States, the Royal Society of the United Kingdom, the Academies of Science of France, of Germany, of Italy, of Russia, of India, of China; every one of them supports the science that says there is warming, that it's substantially affected by human activity. If we don't break the nexus between economic growth and greenhouse gas emissions it will be seriously disruptive to human life on earth.

I conclude from that as a non-scientist that we would be reckless to turn our back on that very clear advice. When you look at the consequences of weakly mitigated climate change then - through the sorts of calculations I did in my original review, there's a strong economic case to invest in mitigation of the effort. We can't solve the problem on our own but the world effort will be affected by whether or not we make our proportionate effort. We've got to do quite a lot before we get up to a proportionate effort.

Once we have decided to make a proportionate effort we should do it in the lowest cost way and the combination of policies that will do it in the lowest cost way will include an economy wide price on carbon. Thank you.

[applause]

TONY WINDSOR: Well thank you Ross. Are there any questions? I'm sure there will be.

BRIAN HARDACRE: I'm Brian Hardacre, Ross. I'd like you to comment on the pros and cons of carbon tax versus an ETS. In particular I've heard criticism of the ETS on the grounds that it's vulnerable to corruption and that there has been a lot of corruption in the European scheme and that it would impoverish the less developed countries.

ROSS GARNAUT: Thanks Brian. Well I think on the first of those questions one does need a good system of regulation for it - for an ETS, no doubt about that. We actually aren't bad at developing those systems of regulation. It's one of the reasons why our financial sector came through the financial crisis better than others but there're some real issues there.

I didn't think the potential for weak regulation - poor regulation is - having looked at it, a strong enough reason to abandon the ETS. On a carbon tax versus an emission trading scheme, in the end it has to be an on-balance judgement and the advantage of an emissions trading scheme, or one advantage, is that you can decide what your emissions are going to be and then let the market set the price. You can be more certain of reaching certain emissions reduction outcome.

If you try to achieve an emissions target through a carbon tax you'll have to vary - experiment with the price, vary it, the tax - it's unlikely you'll get it right to begin with - and in practice it's going to be rather hard to vary the tax, especially upwards, if you're not getting the required mitigation.

On the second point the damage to developing countries, I would see it the opposite way actually. I think this is a large opportunity for developing countries.

The whole world - all major countries need to accept national targets. If you've got those national targets and if the international community agrees that they're fair targets and we're a long way from having that at the moment but that's what we should be aiming towards - then if some countries do better than their targets they will be able to sell excess entitlements to others. That can become quite an important part of the incentive for developing countries to participate in strong mitigation.

On the whole it will be cheaper for developing countries to achieve a given target. Amongst other reasons, because they don't have an established pattern of investment in the energy sector and other sectors and so they can more easily get onto a lower emissions path

and if they do that in a concerted way then they can generate surplus entitlements for export to others.

I spent a fair bit of time with key members of the Indonesian Cabinet when I was working on my original report and they were of a very strong mind that these opportunities for trade and entitlements were critical for them being able to commit the Indonesian - get the Indonesian Parliament to commit to strong mitigation.

MALE AUDIENCE MEMBER: Noel [unclear]. Welcome to New England. We have a tradition of free speech in this part of the world, part of New South Wales even if it relates to such a flawed argument as global warming. My question is what do you consider is the optimum population for Australia?

ROSS GARNAUT: I don't have an informed and well developed view on the optimal population for Australia.

MALE AUDIENCE MEMBER: Your friend Flannery is suggesting five-million or less.

ROSS GARNAUT: I would disagree with Tim Flannery strongly on that.

MALE AUDIENCE MEMBER: I see, that's encouraging.

ADAM BLAKESTER: Ross, Adam Blakester thanks so much, particularly for a couple of chuckles along the way, I didn't expect that.

The question I have is from your research, your views on bringing new energy online onto the grid, particularly clean energy and renewable, and what's needed to get an equal playing field in that regard, because of the sunk capital that's connected up in a particular way, and your views on then how the carbon price mechanism could play a role in that?

ROSS GARNAUT: Yes. Well, the carbon price mechanism greatly increases the incentive for the new sources of energy, but a critical question here is the development of a truly national grid, or at least eastern Australian grid. We don't have a truly national electricity market now. There is interconnectivity between different regions, different states, but in fact the interconnectivity is so slight that there's not an opportunity for large scale movement of power.

In the electricity paper, which I released two weeks ago, I put quite a strong emphasis on the importance of having a genuinely national grid, which will mean much deeper connectivity between the five eastern states plus the ACT.

Just to give one example of the importance of that, the best wind resources in Australia, are on the south coast - right across the continent, but a lot of it in South Australia as well as in the west coast of Tasmania. South Australia generates the equivalent, I think, of

about seventeen per cent of its power from wind energy, or at least it has the capacity to do so.

There are times when the wind's blowing strongly and when demand is relatively weak - if the wind's blowing strongly at three o'clock in the morning when the wind power in South Australia completely absorbs the South Australian requirement and the price of power from generators becomes negative, because you can't quickly switch off the generation.

Now, if you had a proper interconnectivity that would flow through into cheap power going into Victoria and New South Wales at that time. If you spread it over a wider system then you'd be able to balance the requirements more easily. Now, of course, that's a good thing for consumers for the economy, not a good thing for every interest involved.

Talking to one of the Victorian generators they said, *well, we can't have a truly national grid, that would just import into Victoria the cheap power from South Australia.*

WILLIAM HUGHES: Thank you. My name's William Hughes. I was interested, Professor Garnaut, that at the end of your talk you described yourself as a non-scientist and anecdotally I've always been told that economics is the dismal science, so maybe you're not a dismal person at all.

What worries me, I'm not a climate change sceptic, but what worries me is the comparisons of pollutions and emissions based on per capita. And you say that we're emitting twenty-five times as much per capita as the Indians, but there aren't very many Australians and there are an awful lot of Indians and there are an awful lot of Chinese. I believe today the Chinese are registering something like five thousand new motor cars a day, so they're increasing in prosperity and they're also taking over many of the polluting industries which Australia once had and other countries once had.

My question is how can you really be sure that the Chinese and the Indians, perhaps, are going to meet the targets given the size of population and the place where they are on the income curve?

ROSS GARNAUT: Yes. Well, the first thing I'd say is that we won't have effective global mitigation unless there is a very big reduction in emissions intensity of output in big economies like China and India.

How can I be sure? Well, it's already happening. I was talking to the relevant Chinese officials when they were first introducing the policy and I've been talking to them since and the reductions in emissions intensity so far are occurring as under policy and it's a pretty tough - and you could say brutal system - once the senior leadership has decided on a target, they go about implementing them in a very forthright way.

Provincial governors were told how much they had to reduce the energy intensity and emissions intensity of output. They were told there would be inspections and that if they weren't achieving their targets then the central government would send out officials to tell them what plants would be closed down and that's exactly what happened. It's not the way we would do it here and it has some pretty unhappy consequences at times. It's a very expensive way to get emissions reductions, but you can see it actually happening.

India - there's a problem in conflating India and China. India has a much lower level of development and it's not so critical that India immediately introduces strong restraints. It's very important that they develop in a way that is consistent with the low carbon economy that we need in the future. But their absolute contributions are a different order of magnitude to China at this stage.

REBECCA GOWAN: Rebecca Gowan. I had a question about the carbon farming initiative stuff. In the update paper you mentioned that at the first stage of it there'd be a fair bit of learning by doing.

ROSS GARNAUT: Yes.

REBECCA GOWAN: I just wondered, given that the carbon price will likely increase over time, whereas the transactions costs of being involved may decrease, how do you encourage people to sign up in those first initial stages? What's the incentive to be involved as a guinea pig, effectively, when there might be more opportunities later on?

ROSS GARNAUT: Well, the really exciting thing is that a lot of farmers are doing things that are increasing carbon in soils and in other ways right now for other reasons and we saw that this afternoon. And the number of people doing that has increased quite a lot already.

My wife and I for twenty-odd years farmed on the south-west slopes of New South Wales and in the early nineties, no one was using minimum tillage, no one was sensitive to the soil carbon issues, the soil bugs issues. Over a twenty year period, quite a significant number of people had shifted to minimum tillage, were focusing on the value of building up carbon in soils for farm management reasons. So there's already a base for that. So I don't think we have to worry that we won't be able to get things started.

Now, I expect that this will grow rapidly over time and I suggest - and it's a fairly arbitrary limit - that we gradually raise the proportion of the carbon revenue available for these via sequestration activities to fourteen per cent by 2020 and that's by no means the limit of the potential and we will have to review that. It could take off much faster than that and require some earlier review.

It might be hard to greatly increase it unless there was some wider coverage of farming in the emissions trading scheme of that day, but the numbers that I've suggested, the numbers that would generate a

rural biosequestration industry as big as the wool industry by 2020, I think those numbers allow substantial scope for growth. It's by no means impossible that what actually happens will run ahead of that.

IAN DIVALL: Thank you, Tony. Ian [Divall].

Ross, you're obviously a great supporter of the concept of a price on carbon. The figure you mentioned this evening of twenty-five dollars per tonne of carbon dioxide equivalent. If the Gillard Government proceeds with a carbon tax along those lines could you please quantify for us the impact that this would have on the world climate?

ROSS GARNAUT: The important thing is that Australia does its proportionate part in a global effort and no, I can't quantify precisely what effect Australia not doing its proportionate part would be, but it would have some negative effect. If there is a global problem and other countries are all making substantial contributions to it, for us to opt out, to free ride, would be a very substantial step.

We could save money by never sending Australian troops into a war situation in which we were not decisive to the outcome. Who could say if we were not there with the Americans, with the Europeans, with the Japanese and others in Afghanistan it would make any difference to the war outcome. We would save a lot of money from doing that, but it's not the way we look at international relations contributions to say, *can we get away with free riding?*

There's an important global problem, other countries are making a contribution. It's reasonable for us to make a proportionate contribution. If we make a proportionate contribution then if the target were twenty-five per cent by reduction by 2020, which both Opposition and Government have committed themselves to, in the context of a strong global agreement that would be what was necessary to reach the global target of two degrees increase in temperature of this century. That would compare with unmitigated climate change warming of three, four, perhaps five times that amount.

So our proportionate part in an effective global effort - we can't do it on our own, but doing our proportionate part, our fair part, in effective global effort - might make the difference between two degrees and several times that amount.

ROBERT GORDON: Thank you. My name is Robert Gordon. I have a grazing property up the hill at Guyra, which has been happily sequestering carbon for over half a century under my management, such as that is. And - by way of introduction, that's the background that I come from.

ROSS GARNAUT: Yes.

ROBERT GORDON: I'm also extremely concerned about the way that this whole issue is progressing. Tony, you mentioned that we now had a debate here today; we haven't got a debate at all. We have an address, with some

opportunity to respond with a few questions, but the great missing thing in this whole issue has been that there has been no opportunity for public debate.

We get debate from the politicians, the academics, the big business is being consulted, but in terms of the general public they are very confused and very much at a loss and very much of the mercy of the politicians and the advisors such as you, Professor Garnaut. I would suggest to you that your professional opinions could quite easily been seen as compromised by the fact that you have been retained by the Government, right from Prime Minister Rudd's prime ministership and that the Labor Party policy has continued from that time to this.

I will get to a question, ladies and gentlemen, but I also should say I'm not a member of any political party.

MALE AUDIENCE MEMBER: [Could be].

[applause]

ROBERT GORDON: Well, maybe I'll start one, but I don't think so. I'm very concerned about the fact that you, for instance, seem to be ignoring, even denying, the basic maxim of economics when you are designing - helping to design and promote a system which maintains that there will be sensitive usage adjustments by the public to increases in price of essential input, such as electricity and the motor industry.

I mean, it's generally accepted, and I would like to hear from you, whether - how you explain that you appear to be ignoring the fact that the price for essential items for the community are very inelastic, and therefore it's going to be a very imperfect effect which taxing the power generators is going to provide.

[applause]

Tony, I would also like [murmurs from audience] - because there are two strands to this issue, I'd like to put on notice, if I may, a question to you, because the political side must be addressed, because in the final analysis, politics will prevail.

ROSS GARNAUT: Well, three points. First, congratulations on fifty years of carbon sequestration in pastures. [applause] Second, you can look at my record and assess whether I've got a capacity to honour the requirement of independent judgement, which was in my terms of reference when the Government gave me this commission. I've never been known as someone who simply takes instructions. Have a look at what I've written over forty years.

On the third point, the price of carbon introduces incentives on the supply side and on the demand side. In my electricity pricing paper I talked about the elasticity of demand for electricity. A lot of international evidence that in the short term the immediate response is

to reduce consumption of electricity, about point three per cent for every one per cent increase in the price.

In the long term, when people have made adjustments to their appliances and so on, it's about point seven per cent for every one per cent. But in the - in electricity the bigger adjustment is on the supply side. There'll be very big incentives to reduce output from the most emissions intensive sources of energy, which happen to be Victorian brown coal, and to encourage supplies from less emissions intensive sources of energy, and that will start happening very early in the scheme. Over time that will be a powerful effect.

RICHARD MAKUM: Richard Makum, Professor. I'm a grazier also. My question is in relation to a statement that you're attributed - was attributed to you about twelve or eighteen months ago in the media that the grazing industry would be much better suited to running kangaroos than ruminants.

It intrigued me, because I do know a little bit about grazing, not a lot about economics. The fact as I saw was the ruminants are helping with a lot of fire reduction across the rangelands of Australia, which is about seven eighths of Australia, and what would happen when we went back to the monogastric kangaroo, and the amount of green stuff that it likes eating in its diet without handling the dry stuff, which is as - you know, every Australian knows that where they see them run off side of the road, and all the kangaroos are getting run over.

The - I don't see that it - I understand where you're coming from on methane, and the reduction of methane, but I couldn't see how that would be any use to us if we - if our rangelands go up in smoke every couple of years through the fuel loading.

ROSS GARNAUT: Well you don't have to rely on rumour, you can read what I actually wrote and it's there in my report, which is on the Garnaut Review web site. I said that over time if there was a price on carbon, including carbon dioxide equivalent in the form of methane, that we'd on the consumption side, there'd be encouragement of low emissions forms of meat relative to the ruminant meat.

But quite clearly in the paper the maximum role of kangaroo was going to be a minor one for a very long time into the future compared with the traditional Australian ruminants. You don't have to rely on rumours, you can read what I actually said.

RICHARD MAKUM: I think the media missed that bit there.

[laughter]

ROSS GARNAUT: Yeah.

RICHARD MAKUM: Thank you.

ROB BLOOMFIELD: Rob Bloomfield. Professor Garnaut I'm just a little bit worried about this carbon tax, and I - we obviously don't know where it's going to come from, and what it's going to do to us, but the way I read it it's going to have a huge input on energy, and energy is an integral part of every business in Australia.

From that, I was just looking at my profit and loss account the other day, and there's about fifty or sixty entries, and every one - if there's an increase in energy - everyone of those inputs is going to go up on my farm. If that's my farm, that means every business is in the same position that supplies me.

I'm just wondering how you're going to stop those prices cascading back to the farm gate, and we can't pass it on. And it'll also cascade the other way. If you don't want food prices to go up to the consumer, it'll come back to us again, and I feel that we're in a very weak position. I'd just like you to make a comment on that.

ROSS GARNAUT: Well for my last review I did a lot of detailed modelling on the effects of costs across the economy - well I've made some very specific recommendations in relation to fuel, which would avoid the initial impact affecting costs related to fuel. You can see that in my carbon pricing paper, number six.

Generally, the cost impact across the whole economy is going to be a bit less than one per cent of the overall cost level. From very energy intensive industries it will be higher than that, especially for electricity using industries. For farm inputs, or for fuels, it will be a proportionately smaller impost than, for example, the GST. As with the GST, for a substantial number of households the revenue will be handed back.

For the rural sector as a whole, even a small take up of the biosequestration opportunities I was talking about, will be many, many, many times larger than the increase in energy costs. That's all in there, and from the modelling from last time.

I'm under time pressures - have to give a final report to the Multi-Party Committee, and to the prime minister by the end of May. I can't do all that modelling again, but the Australian Treasury is doing all that modelling again, but I don't think things will have changed very much from that work three years ago.

TONY WINDSOR: I'm not sure who's next. I'll let the lady go first.

YOUNG FEMALE AUDIENCE MEMBER: China is a significant purchaser of coal from Australia, so as China transitions to renewable energies, what's that going to mean for the Australian economy?

ROSS GARNAUT: Well, I think that's a very important question. I think that Australians aren't thinking as much as they should be about China's transition away from imported coal. Australian coal goes to imported - coastal

China. China's got a fair bit of coal itself, but it's in the deep inland. It's very expensive to get coal from where the main coal mines are to the big coastal cities. Transport's much easier and cheaper from Australia.

Coal's gone up in price about five hundred per cent in the last half dozen years, and that has meant that the balance of costs between coal based generation in coastal China and other sources, especially nuclear, has balanced - has evened up a lot. So there is a risk to long term exports of thermal coal, power generation coal from Australia.

What would it do to the Australian economy? Well it would lead to some reduction in our terms of trade. It would reduce government revenues and so we would all share a bit in the cost of that. It would mean a lower exchange rate, so the exports of education services from this university, the exports of all of our farm products would be more valuable.

The export value of all of our export products would be greater. This resources boom has raised the overall cost level in Australia quite a lot, so you'd have reverse pressures on costs. So it would - on average it would make Australians poorer not to be exporting such - so much coal at such high prices.

Certainly all the other export industries would find their circumstances better. The resources boom has put huge pressure on other export and import competing industries in Australia. It's not just the high exchange rate, \$1.05, a level that we couldn't - very few people contemplated as a possibility a few years ago, but that's alongside a much higher rate of basic inflation in Australia than in our main trading partners.

So the real appreciation of the exchange rate coming from the resources boom is much bigger than when you just look at the nominal exchange rate. So for the Australian economy as a whole, if China succeeds in putting a cap on coal production - coal imports in a few years time - it won't happen immediately - on average we'll be a bit poorer.

Government revenue will be a bit lower. But the farm industry, the education industry, the tourism industry will find their incomes rising. So there'll be an internal distribution effect that for a lot of people around here won't be an adverse one.

BOB BAKER:

Thanks Tony. My name's Bob Baker. A bit nervous. Last year I completed a Bachelor of Natural Resources degree, which is a fairly serious science degree. I referenced your review in my thesis, and I think you did an excellent job. I think there's no doubt you've picked it and got all the nasty points.

Anyway, my question - I'm firmly convinced we could even reverse carbon emissions in Australia, and it wouldn't kill us. It would actually do us a lot of good. What I'm concerned about is we should be

helping farmers biosequester carbon, but in an open market - just say I'm a farmer and I grow say a thousand tonnes of timber and claim say twenty-five dollars a tonne credit, and I've locked that away. Right, yes, yes, for the carbon dioxide conversion. [laughter] Yep.

Anyway, say my thousand tonnes of carbon - are you talking twenty-five dollars a tonne of carbon dioxide, or a tonne of carbon?

ROSS GARNAUT: Carbon dioxide.

BOB BAKER: Carbon dioxide, right, so that's about a third or a bit less than a tonne of carbon. Anyway, a thousand units, and the world wakes up and sees that we've really, really got to cut down emissions, and the price of carbon goes through the roof, and through no fault of my own my thousand tonnes of carbon dioxide equivalent goes up in smoke, and the price is now a hundred dollars a tonne.

I might be up for a liability for three or four times of what I've actually got in the first place. Is there a way that you can protect farmers from that? Because I think it is very important that farmers are encouraged to engage in this.

ROSS GARNAUT: Yeah, that's a really important issue, the question of permanence, and obviously you don't want to reward impermanent carbon sequestration. There's two mechanisms that can be put in place, and they are actually embodied in the Government's new Carbon Farming Initiative, which is the legislation that's about to go to the Parliament, I think.

One of those is that if that sort of thing happens you don't - in those sorts of circumstances you don't pay back the money, but you don't get a credit until your timber is built up to that old level again. Other sorts of accidents - if you decide that suddenly dairying has become more valuable than carbon sequestration and decide to chop down the trees then you would have to pay it back.

There are also possible insurance mechanisms, where you pay a small proportion of the value into an insurance mechanism to cover that sort of accidental thing. They're serious - very serious issues that have been, I think, seriously addressed in the Carbon Farming Initiative. I've got a little bit about that in paper number four.

FEMALE AUDIENCE MEMBER: I think you've just answered my question, because I was going to - I was asking about the problem in the Kyoto protocol whereby biomass is treated differently than - we don't directly tax the emissions when the carbon dioxide is released, and we don't give people credits when the trees are growing and the biomass is increasing. It's all handled by this LUCF term. And I was just wanted to make sure that you believe that a more sensible handling of biomass would be better for this country.

ROSS GARNAUT: Yeah. And in my recommendations, I've gone - I've said that where there's genuine biosequestration and, where it doesn't qualify under

the current international rules, we still should reward it and argue for changes in the international rules. That's part of my recommendation.

MALE AUDIENCE MEMBER: Thank you Professor. I just wanted to refer to a document entitled *The Policymaker's Guide to Feed-in Tariff Policy Design* and I just want to quote this: 'Feed-in tariffs are the most widely used policy in the world for accelerating renewable energy deployment, accounting for a greater share of renewable energy development than any other policies. Would you agree with that and is that something that is being looked at a national level?'

ROSS GARNAUT: I'd agree that it's very widespread and it may be the case that it - no, I don't have the information to agree that it's the most important encouragement to renewable energy. It may or may not be. It's certainly very large, very large in Europe, very large in some Australian states.

It can be a very expensive way of doing it. It's not how I'd set about encouraging renewables. I'd do that through a combination of a carbon price, fiscal support for research development and commercialisation of new technologies, rather than through the feed-in tariff.

The case - there's a case for some support, for some special support - for investment in new sources of low emissions energy, where it cuts the peak off existing demand, and so, obviates the need for such large investments in distribution in power.

Even that one - which is sometimes used to justify a feed-in tariff - I think you can encourage that through some other mechanism. So, I'm not comfortable about the - in general - about whether the feed-in tariff is what - is the most economically efficient way of doing things.

MALE AUDIENCE MEMBER: I want to take you back to when you said something about there was a fairly good input of soil science into farming industries. Unfortunately over the last twenty years there has been a demise in the amount of money going into agricultural research and, principally, into extension as well.

Do you think that we're going to have a change in these areas to see this idea of agriculture having a large part to play in the reversal of carbon dioxide?

ROSS GARNAUT: That we do have that reversal of - and it's quite right - especially in the public sector the state departments of agriculture, even though the CSIRO does a lot of work on agriculture, I think there may have been a reduction in total agricultural research effort in real terms over the last couple of decades. Certainly in the state departments of agriculture there's less and I think we are suffering from that.

Unfortunately, that's part of a global trend. There's a pullback in public support for agricultural research. This has been a period where there's

been a big increase in private research by the large agri-businesses, but they don't do exactly the same sort of research and so I think there is a problem there.

I've suggested that this issue be addressed by making sure that the large amount of money that I've recommended go into research development and commercialisation of the new technologies, that a substantial part of that goes into research related to the biosequestration. I've suggested some mechanisms for that and I'm sure that Tony, on the Multi-Party Committee, will make sure that that particular recommendation gets a fair hearing.

FEMALE AUDIENCE MEMBER: Professor Garnaut, why is the Government so reluctant to pass legislation for reducing emissions over a period of time for the heavy-polluting industries, and why in the scheme that you're proposing - or that you're looking at - is the CO2 tax more cost-effective than the US proposal of direct legislation?

ROSS GARNAUT: Well, I'll answer that generally. When you do something through a market mechanism - like a carbon price - then every household, every business in the country can respond to that incentive. When you do it through regulation - and this what the Secretary for Energy in the United States Cabinet, in President Obama's Cabinet, explained to me - Steven Chu the Nobel Prize winner in Physics.

When you do it through regulation, it's the brains of the people in government deciding to do this and this and this and this, and we've found through a lot of experience, that when you use the brains of the whole community - every household, every business responding to opportunity - you get more good ideas when you get a limited number of bureaucrats deciding to do this and this and this. The big test of that was in the contest between Soviet central planning and western market economies - and the western market economies won.

YOUNG FEMALE AUDIENCE MEMBER: Hello. Thank you very much for tonight, it's been great. I was wondering about - sorry, I'm really, this feels really strange to hear my voice - [chuckles]. I was wondering about your use of nuclear and coal seam gas as ways of managing and, frankly, that frightens me, because I don't - like, it seems like such a dirty, polluting, it might not be carbon, but it's the other pollutants that that puts into the environment and the contamination is...

ROSS GARNAUT: Yeah. Well...

YOUNG FEMALE AUDIENCE MEMBER: ...really frightening.

ROSS GARNAUT: Yeah, well gas - whether it's coal seam or natural gas - just happens to have much less emissions than burning coal, or even burning oil, but, certainly than burning coal. So - I - now where there are other external costs from a particular technology, then that has to be taken into account. If coal seam gas in a particular place does other environmental damage then the community has to properly value that

and take decisions on whether that's warranted on those other environmental grounds.

Similarly with nuclear - incidentally, my analysis says that nuclear doesn't make sense economically in Australia, because in Australia, it's likely to be much more expensive than other forms of energy including natural gas, because we've got such good alternatives.

Australia is the main supplier of liquefied natural gas to Japan, to Korea, to Taiwan, to China. It's the main source of uranium oxide to Japan, to China. If we are exporting both gas and nuclear - and uranium oxide - it makes sense for us to burn the natural gas here and to export the uranium oxide. Just - leaving the politics and policy out of it completely - the economics would drive us to use natural gas and others to use the nuclear.

Now there are some big questions about safety and about nuclear proliferation of weapons. In relation to nuclear, these are serious questions and I don't pretend to be an expert on any of those things. There are a lot of people who are experts, who say that the modern technologies don't involve the risks that were associated with Fukushima, with Chernobyl, with Three Mile Island. I'm not a person who can make a judgment about that. The whole world is - all countries that are looking at nuclear energy are looking at Fukushima and judgments will be made in the light of that about what that says about safety.

On nuclear weapons proliferation, I do take - I think it's very important that we only export uranium to countries that have - that are part of the nuclear proliferation treaty. I think that's a very important part of the nuclear system. I do remember that Australia in the time of the Whitlam Government made a very big effort to encourage Iran to shift from burning oil to nuclear energy at a time when Iran was allied with the United States and with Australia.

If we had succeeded in becoming a big exporter of nuclear material to the Iran of the Shah, then that would have been inherited by Ayatollah Khomeini. So I am aware enough of all of that history to be aware of the risks. These are serious issues where the nuclear generation of power is judged by the people who actually understand these things to be safe.

Where the safeguards are in place about weapons proliferation, you can say about it that it's a zero emissions source of power and that's really all I'm saying about it. The questions of safety and weapons proliferation are important questions in themselves. People need to make judgements about whether they are such big problems in themselves that nuclear should be downplayed.

SCOTT HARRISON: Scott Harrison from the UNE Economics Society. I guess my question really relates to the correlation between population size and gross

amount of emissions. In economics, it's common to make assumptions regarding the models that we put forward. What assumptions did you make regarding population growth in Australia and its impact on carbon emissions over time? And do you think Australia needs a comprehensive population policy to support a carbon reduction scheme?

ROSS GARNAUT: Well, the answer to the last question is no, because I think that, in the end, any international agreement on distribution of emission entitlements will be based on a per capita basis. So, with more people our entitlement would grow. I don't see any other basis that's likely to get the support of India - of the major developing countries. China would prefer not to - they would prefer to base it on historical population and not population of the day. They say, *we've taken drastic action to help solve a global problem. Our population will be declining from a point, soon, in the future. It will be much lower in 2050 - we should be rewarded with that by basing entitlements to emissions on past figures.* But I don't think that argument will carry the day in the wider international community.

Another way of looking at the question - our population grows through immigration. Our natural increase - well, we would decline over time with our current rate of natural increase for fertility, which is below replacement level. Replacement level is 2.1 babies per woman in the childbearing age and we're significantly below that. So, our population growth comes from immigration. If a migrant comes from England or China or India to Australia, I think it's reasonable to think of their entitlement to emissions coming with them and not staying with the country in which they come from. So, I see the population issue as a separate issue.

DAVID WALKER: David Walker from Liverpool Plains Land Management and Plan Care. Professor, thank you very much for your talk. We've been discussing tonight the implementation of a price on carbon generally and in particular its impact on agriculture, given we're in an agricultural area.

Given the deep scepticism in the wider community - we seem to need to sell this idea to the wider community generally and also the farming community. Given the scepticism with which many people in the community view policies that come from Canberra - and if I can use an example, the screaming failure of the Murray-Darling Basin plan...

ROSS GARNAUT: I live in Melbourne now.

[laughter]

DAVID WALKER: It's still a big space, still a big - but given the scepticism and suspicion that many in the community feel to these policies that come from on high, what ideas have you got in terms of getting community engagement and selling the idea, firstly to the wider community and also to the farming community?

ROSS GARNAUT: Well my - I've been asked to work out what policies will work best to analyse the question and to be honest I'm not the world's best expert in public education but very clearly this is a complicated issue. There does need to be a lot of public education, genuine education not advertising and propaganda but genuine education.

We've had some comparable public education programs in the past, probably not on anything quite as complex as this but, you know, thinking back to the program when AIDS first became an issue in Australia through a whole variety of channels. There was a bit effort in public education and it did affect both attitudes and behaviour and as a result we were one of the countries that - where the spread of AIDS was contained at a relatively low level at a relatively early stage.

I think there are probably lessons to be learned from that. I recognise that this - the public education issue is crucially important but I'm not your best expert on how to do it.

FEMALE AUDIENCE MEMBER: I was going to say it's the last question, how very fortunate but the penultimate questioner just asked my question so I think that this town hall meeting if you like is very helpful because here you have the example of a literate and educated audience who clearly have thought about the issues and we can't clone you, Professor Garnaut, because you're obviously very busy doing the report but I think that it is an issue that we all need to take some responsibility about in terms of raising the - you know, the lowest common denominator debate that's happening, you know, across the country where ignorance and self-interest seems to be - plus some partisan interests seem to be holding sway.

So I guess all I can say, given you've already answered my question, is to acknowledge the principled representation of the federal member for New England in this matter, as in others, and to make sure that we, as a group, contribute to that general debate and education of our fellow citizens so that there is informed debate.

I agree we need debate, another speaker spoke about this, but debate will be useless unless it's informed and educated and hence a very important responsibility on us all.

ROSS GARNAUT: Thank you [applause]. Well I will just say one more thing about that. Every word of advice I've given to the Multi-Party Committee or to the Government is there on my web site, garnautreview.org.au and all the reasons for it in painful detail.

So to the extent that what I've been saying to Government or the parliamentary committee is relevant, it's publicly available, part of the resources that people might want to use. Thanks.

[applause]

TONY WINDSOR:

Well thank you very much, ladies and gentlemen, for taking the time. Thank you, Ross for putting in so much time out here and this afternoon and the obvious work you've done in the past in a whole range of areas. This debate will go on, I've got absolutely no doubt about that.

One of the very interesting parts of the political process at the moment is that it is, as David Walker mentioned too, the Murray-Darling for instance - they are very, very significant living debates, in a sense. I think there will be plenty of room for people to make constructive arguments in terms of the issues and the effectiveness of policy, particularly in an issue like this that obviously has potential international consequences.

But before you do go if I could relate a little story. My wife's heard it before and I think you've been such a good audience I should tell you and it is a true story. A friend of mine, who is a painter by trade, and I was having a cup of coffee with him one day and I asked how his father was going and his father was an eighty-six year old man and he's had tuberculosis for fifty years, so he said he wasn't travelling all that well.

Tuberculosis for fifty years and he was a lead painter all his life, a cigarette smoker and a drinker and he was at the doctor this particular day and the doctor said to him, he said do you think you could have the odd alcohol free day and the old fellow looked up at him and thought about it for a while and he said, what about two half days?

[laughter]

So it depends how you look at it, doesn't it but – and then the doctor said to him, he said you know, the grog's slowly killing you and the old bloke looked back up at him and he said, well I'm in no hurry.

[laughter]

I think that - that is a true story but I think it applies to the issues that we're trying to deal with, whether it be the Murray-Darling or the climate change debate, are we in a hurry, should we be in a hurry? I think the last questioner sort of hit it on the head in a sense that we really need to try and get as informed as we can.

Obviously we're not all going to become scientific modellers of climate but I think we've got to try and get some sort of understanding of the issues that are out there, whether the precautionary principles should apply and if so, how.

I do thank you all for taking the time and particularly Professor Ross Garnaut for spending the day in our area. Thank you. [Applause]

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