

Edited transcript from audio tape:

**Australia as a Superpower of the Low
Carbon World Economy: A Western
Australian Perspective after Finkel and
Frydenberg**

11am -12:30pm

Friday November 3 2017

Murdoch University, Western Australia

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I am grateful to Yann Robiou du Pont from the Australian-German Climate and Energy College
at the University of Melbourne for his work on charts on slides 29 and 30.

Western Australia is host to the Australia Germany Asia Pacific conference, at which there will be discussion of the Australia German Energy Transition Hub. This lecture is part of those activities.

The Australia Germany Energy Transition hub involves cooperation among leading Australian and German universities and research institutes. We are grateful for the strong support of the Turnbull and Merkel governments that was announced at the Hamburg summit earlier this year. The Turnbull-Merkel support helps to lock in the international cooperative parts of the venture. We look forward to justifying the interest and confidence of the two heads of government with research output that is interesting and helpful to the energy transition in the two countries.

The main initiative at the Australian end in pulling everything together has come from Malte Meinshausen at the University of Melbourne and Frank Jotzo at the Australian National University. It is good that Frank is here with us today. German colleagues from the major climate and energy research institutions have also made large contributions. The new institutional arrangements will support the sharing of ideas and research on transition to the zero-carbon economy. The comparative advantage of the Energy Transition Hub comes from its long horizons, its analytic depth and its independence from political and business interests. The research program will be sustained over many years and the subject of our research has long horizons. We have a capacity to find the best results from first principles and our research will not be constrained by temporary fashion or political and business interest.

Australia emerged as the super-power amongst developed countries of the fossil global energy economy. Australia is by far the world's biggest exporter of coal when you take thermal and metallurgical coal together. It is currently the second biggest exporter of gas, and may be headed soon to be the biggest. It is home for many of the most energy intensive industries: Australia became the world's biggest exporter of aluminium in the late twentieth century after the Japanese industry, responding to environmental concerns at home, moved to importing metal, and Australia's low coal costs made it the logical source of much product. Australia in the old fossil energy economy had a special advantage in minerals and food processing because we had the local raw materials supply as well as abundant and cheap energy.

Australia lost its old advantages in the fossil energy world economy in the twenty first century as a result of several developments. One was the internationalisation of our domestic coal and gas markets. The gas developments have been recent. Huge investments in gas processing for export were made in Gladstone, based initially on prospects for coal seam methane. That was bound to raise domestic prices towards export parity. The price increases were larger because the three sets of investors established an amount of export capacity that exceeded gas availability. That led to

scarcity, and at least for a while to export prices above export parity. Over a couple of years, eastern Australia went from having the lowest to amongst the highest cost gas in the developed world.

The Commonwealth Government has taken steps recently to reduce the domestic price impact of gas exports, notably through legislation that allows restriction of gas exports. That may help. But it will leave domestic gas prices much higher relative to international prices than they used to be. It will confirm a deterioration in the competitive position of Australian industries that use gas intensively, and which use intensively electricity which relies heavily on gas generation.

WA is different, because of the decision to reserve part of the gas resource for domestic use. That currently has the potential to give WA industry a competitive advantage over eastern Australia in manufacturing processes in which gas or electricity is a major cost.

The increase in domestic relative to international gas prices is the largest but only one of the sources of increased electricity prices which have cancelled Australia's competitive advantage in the old fossil energy world economy.

We made some fundamental errors in policy for and regulation of our electricity sector in the early twenty first century. We privatised and corporatised networks--the poles and wires--without putting in place effective and efficient price regulation. This led to massive overinvestment in the network, with costs being passed on with a high guaranteed rate of return to users of electricity. There was almost no increase in use of the transmission and distribution network from 2006, when the regulatory system settled into its current form, until 2016—almost no increase in either total or peak electricity use through the NEM. Bruce Mountain (2017) estimates that the real level of the Regulated Asset base—after extracting the effect of inflation—rose from \$52 to \$90 billion over the decade. The passing on to users of that immense increase in costs helped take away the advantages of Australia as a location for energy-using activities in the old fossil energy economy.

In the low carbon world economy Australia has similar, perhaps even greater natural advantages than it once had and then lost in the fossil energy economy. We are the developed country most richly endowed with natural resources for renewable energy. Amongst the established sources of renewable energy that are growing most rapidly around the world at the moment – wind and solar – southern Australia has combinations of rich resources for solar and wind that are unique in the developed world. South Australia in the Upper Spencer Gulf and on and north of the Eyre Peninsula is particularly rich, but the endowment is also bounteous in Western Australia. The westerlies on the coast south of Geraldton are a strong wind resource and much of the state has rich solar resources. The bioenergy potential is considerable in parts of the state. Tidal and wave power will become important in future. That combination can be the base of considerable competitive advantage in low-cost energy.

No other developed country has opportunity comparable with Australia in per capita generation of low-cost renewable energy. The point was brought home in a visit from the Director of the German solar energy programme when he was visiting me when I was working on the original Climate Change Review. The visitor from Berlin said that in preparing for our meeting he had discovered that the worst place in Australia for solar energy is the west coast of Tasmania. "I have worked out", he said, "that the west coast of Tasmania is better than the best place in Germany. That is the circumstance in which I have to run the world's biggest solar program".

The rich natural endowment of potential for renewable energy means that when the whole world has low or zero emissions energy, Australia potentially has the lowest cost energy. To take advantage of that opportunity, we have to make fundamental changes in policy and regulation. This

isn't only about climate policy. Nor is it only about policy in the energy transition. It's about energy policy in general.

We've made a mess of energy policy--a mess that has been compounded by making a mess of climate policy. With reform to integrate climate and energy policy and to put focus on efficient provision of low cost, low emissions and reliable energy supply, then Australia is disproportionately the natural home for energy-intensive economic activity in the zero-carbon world economy. Unlike the advantages we used to have in fossil energy, the advantages from renewable energy are sustainable. The advantages for domestic energy users will not be taken away by making the domestic resource exportable, as it was with domestic gas in eastern Australia and coal in Queensland and New South Wales. One day--and Western Australian Regional Development Minister Alannah MacTiernan has commented on the potential--one day there probably will be long-distance high-voltage DC transmission from the northwest of Australia across Indonesia to the Asian mainland. But that's not going to be cheap. Australia will remain a relatively low-energy cost country when we are linked into the Asian transmission system.

If national regulation continues to falter, and the rest of Australia through the National Energy Market fails to take advantage of its opportunities, then there is an opportunity for WA. If the rest of Australia continues to shoot itself in the foot with a failure to integrate climate and energy policy, and through mismanagement of energy policy, then Western Australia need not be held back from using its own new energy advantages. From that point of view, the isolation from the NEM is a potential opportunity.

This state, outside the NEM, can be an island of competitive energy and energy intensive investment. I'll come back to that at the end of the lecture.

Opportunities in Australia Germany cooperation

Australia and Germany both have world leading primary research capacities in climate and energy technology. Getting together and sharing that has tremendous value.

Already indirect cooperation between Australia and Germany has played a big role in the emergence of highly competitive solar and wind power. In the case of solar a lot of the world leading research on the technologies--the pure research, and the purer end of the applied research--has been done in Australian universities: particularly ANU, Melbourne, and the University of New South Wales.

Reform of tertiary education enabled the cooperation. It's interesting to reflect that 30 years ago it was illegal to take in foreign students for a fee. That changed in 1986. A number of students in electrical engineering from the university of NSW went back to China after graduation. They started up new solar companies, using the huge opportunity created by Europe and especially Germany introducing strong incentives for installation of solar photovoltaic power systems. At that time, the cost of photovoltaics was much higher than conventional energy. The incentives created a strong demand for solar PV panels. Young Chinese entrepreneurs trained in Australia started producing for the European market. At first the new Chinese producers focussed mainly on the export market. As the Chinese firms expanded their output, costs came down. The Chinese firms learned how to manufacture more efficiently, taking advantage of the many strengths that China has in large-scale manufacturing. Costs came down further. In combination with domestic policies in China favouring renewable energy from 2012, lower solar PV panel costs allowed the Chinese firms to sell strongly in the domestic market and now the large majority of sales are in the Chinese domestic market.

The process of expanding output and falling costs brought the global cost of photovoltaic panels right down, by something like 5/6ths since I incorporated estimates of future costs of photovoltaic into my modelling for the Climate Change review a decade ago. That reduction in cost has made solar energy from photovoltaics highly competitive over the world. Recently, global tenders in favourable solar environments, like Saudi Arabia and the Emirates, have led to electricity costs well below 30 USD a megawatt hour. This is spectacularly lower than even the operating costs of most fossil generated power.

So we can see how cooperation between Australia, Germany and China through market processes has played a huge role in reducing global renewable energy costs. That has facilitated the transition to renewable energy. It has helped Australia mainly because we now have access to very low-cost solar PV generation.

Australia and Germany in different ways are at the global leading edge in deploying low emissions technologies. Although our policy in Australia has been stopping and starting and from time to time incoherent, our natural advantages are so large that despite the occasional incoherence, there has been very strong growth in renewables. The penetration of photovoltaics on household rooftops has gone much further than anywhere else in the world. Nearly one in three households in South Australia, only a bit lower in Queensland, and over one in five and rapidly growing in Australia as a whole. That makes us a very interesting country for people interested in the frontiers of application of technologies. South Australia has over half of its electricity coming from solar and wind and has been much criticised for it in some quarters. In my assessment, South Australia is in the process of overcoming the problems stemming from high penetration of intermittent renewables, and that is of global interest. Germany is at the cutting edge of innovation in a lot of engineering and manufacturing applications that embody high technology. We're of interest to each other for those reasons.

Australia's policy tangle has generated what our Commonwealth Energy Minister, Josh Frydenberg, and Commonwealth Chief Scientist, Alan Finkel, have described as an energy trilemma. The first horn of the trilemma is high perceptions of insecurity of our electricity supply--perhaps excessive given the realities, but the perceptions are real. The second horn is that we have close to the highest residential electricity cost in the developed world, our household costs for residential electricity are extremely high but our industrial costs are now also high by global standards. The third horn is that we have by far the highest total electricity emissions per person in the developed world. We were bringing emissions down quite rapidly between the middle of 2012 and the middle of 2014 when we had an emissions trading system with a fixed price, but they've gone up since then. The first and second of these horns--the high perceptions of insecurity and the high cost per person--are new since late last century. There's been belated official recognition of the trilemma, especially since the blackout in South Australia last Spring and the load shedding in New South Wales and South Australia in February this year. The problems of the Spring and Summer had the one beneficial effect--they focussed attention on the need to manage the grid in a different way for stability when there is a high proportion of renewables. Grid stability within the NEM is, of course, a national issue and the Chief Scientist was commissioned to do a report on energy security and reliability as a result of the Spring episode. That was the Finkel Review, commissioned in the immediate aftermath of the South Australia blackout and completed in mid-2017.

Recently energy featured in the Productivity Commission's 5-yearly Productivity Review. That Review is not only or mainly about energy, but the decline in productivity in our electricity and gas sectors made that a significant focus of the 5-yearly review. The Australian Energy Market Operator's advice to the Commonwealth on reliability was presented in September. We saw the Australian

Competition and Consumer Commission's price review on competition and price in electricity in September. In Victoria, the Thwaites review of prices reported at about the same time. Most recently, the Energy Security Board established as a result of the Finkel Review wrote a letter to the Commonwealth recommending a National Energy Guarantee in October 2017.

I will say a little bit about each of those reports. They have come one on top of the other and there's a lot of interesting content there that has mostly been overlooked in the public discussion. Journalists from the majority Australian newspaper conglomerate have had prior access to a lot of the material that comes from the Commonwealth and their writing it up in a certain way with various omissions and interpretations shapes discussion and moves attention away from some important issues.

Here I touch lightly on some of the important issues that these reports have raised and which have not figured prominently in the public discussion. The Finkel Review is about energy security and reliability. Most of the recommendations were related to these matters. These were generally well received, and accepted by the Council of Australian Government (COAG) Energy Ministers. Several of the more important of them are in the process of being made operational by the Australian Energy Market Operator. A new Energy Security Board would coordinate the work of the three regulatory agencies and their interaction with the COAG Ministerial Council.

But the report wasn't much about climate objectives or policy. There was no analysis or even discussion of either the atmospheric physics of climate change, or the international diplomacy of policy. There was no discussion of the content or implications of the Paris agreement on climate change. The Finkel recommendations included the establishment of a Clean Energy Target, around which policy directed at energy and climate change objectives could be integrated. In a draft report Finkel had proposed an Emissions Intensity Scheme. This was ruled out by parts of the backbench of the governing parties at the end of last year. In consequence, the formal Finkel Report focused on an alternative, that hadn't been ruled out, the Clean Energy Target. However, the Clean Energy Target was ruled out by the Coalition back bench once its members were aware of it. The Energy Security Board's National Energy Guarantee is really an attempt to fill the vacuum.

The Productivity Commission Review noted the large decline in productivity in our electricity sector, I've already mentioned the immense investment we've made in our network for no increase in output. That's what a decline in productivity is. It is so large as to be of national economic significance. The Productivity Commission said we need national agreement on objectives of price, carbon emissions and energy security, that recognises the tensions among them. It noted that network regulation has led to overinvestment and high costs to users. And it noted the analysis that reveals that if we're going to reduce total emissions by 26 to 28%, we'll have to reduce emissions in electricity by around 50%.

The Productivity Commission noted the conclusion of economic analysis, that a broadly-based carbon price is needed to reduce emissions at minimum costs. This is an elementary point. It was once an uncontroversial point. The classics of the market economy—including the contributions of such market fundamentalists and supporters of minimal government as Hayek and Friedman, say that effective operation of a market economy requires taxes or regulatory restrictions on external environmental and other costs from a firm's business decisions. You need a carbon price or you are

subsidising the emitting industries. This was once an elementary and uncontroversial point, and the Productivity Commission was bold enough to remind us of it.

The AEMO advice came as a letter to the Commonwealth Energy Minister a month ago. The advice is a model of clarity and sound analysis. It's a pity that it wasn't given more oxygen when it first came out. I am encouraging people to look more closely at it. The letter said that if we didn't do anything we'd have a big problem in South Australia and Victoria over the coming summer and a possible problem through the following summer. It also said that we were doing something. The letter noted that there was a short-term need for about a gigawatt of flexible reserves in South Australia and Victoria to get us through the summer that's almost upon us, but also need some of that for the following year. It noted that what it was doing in sponsoring a market for demand management and reserve supplies of power of various kind and what the South Australian government had done in its energy plan meant that the problem was in hand. Now that wasn't interpreted like that in much of the public discussion which emphasised a continuing crisis. But AEMO made it clear the problem was in hand. That letter from AEMO also said that in the long term we need to embed markets for grid stability services into the NEM rules. These would need to include a market for reserve capacity. Here, what was necessary was flexible dispatchable energy that can respond very quickly to changing demand or to changing supply from intermittent energy. These responses are necessary when there is a high proportion of intermittent energy in the system. AEMO draws a clear distinction between flexible dispatchable power and traditional baseload power of the kind that comes out of an old coal generator.

For the longer term, AEMO advised that we need separate markets for a range of grid stability services and we need to create new markets for some services. There are already markets for half a dozen different frequency control ancillary services (FCAS) of different speeds of response. These provide the basis of a system of market services for grid stability and can be extended. In particular we have to develop a new market for forward looking flexible, dispatchable capacity.

The AEMO letter notes that we need capacity held in reserve and separated from the normal energy market. By implication it commends the approach that's been taken by the SA government to the 250MW of reserve capacity. AEMO noted that flexibility can come from reserves of spinning generation capacity or from long distance transmission, from other network services like batteries, from demand response and from pumped hydro storage. Clearly what AEMO had in mind is developing a market process that discovers the cheapest way of putting the necessary reserve capacity in place. The report noted that for the longer term we'd need a gigawatt of this type of reserve capacity to manage the closure of the large coal base station at Liddell in the Hunter Valley in New South Wales in 2022. It clearly had in mind putting in place the systems that are necessary to provide those services. It noted that traditional base load doesn't have the required characteristics. It noted that there needs to be a separate requirement and market for minimum synchronous generation for inertia, and that it was doing the work required to define what was needed in each region within the NEM. The proportion is lower in a bigger system and regional requirements vary.

More generally, AEMO is saying that we need new types of markets, rather than clunky regulatory mechanisms, through which grid stability services can be supplied.

The ACCC review of prices is in draft form at this stage. The final report will be coming out later this year. The draft focused on the importance of oligopoly in raising prices in Australia--oligopoly both in

the retail and generation. The oligopoly is especially severe in South Australia but important right across Australia. It said that the integration across generation and retailing within the National Electricity Market, with the major retailers being also the major owners of generation, need not give rise to a monopoly problem, but in practice did. The problem was most obvious with the big coal based generators.

The ACCC noted that a unique and antediluvian Australian practice of averaging prices for settlement across half hour periods created an opportunity for using monopoly power to raise average prices. The averaging across half hour periods reduces the private incentives and systemic benefits that fast-responding new technologies like batteries would bring into the market. It noted that there had been a large historical problem of over-investment in the network. The regulators had started to reduce the extremes of wasteful investment, and would be helped by the Commonwealth' recent removal of one-sided rights of appeal against Australian Energy Regulator decisions. However, the history continued to impose heavy costs on power users: network companies continue to charge consumers for wasteful investment in 2006 to 2013.

The ACCC noted that modelling suggests the renewable energy target may reduce or increase wholesale prices. This is a really important point. In some ways it is counter-intuitive. The Chief Executive of the Business Council of Australia, Jennifer Westacott, can't be characterised as someone who's supportive of expansion of renewable energy in general. Westacott said recently that "ironically", the rapid expansion of renewable energy to fill the Renewable Energy Target (RET) quickly is probably the most important way we can reduce electricity prices in the short term. There is actually not much irony in the relationships upon which she was commenting. Her conclusion falls out of standard analysis. Several recent studies have seemed to surprise their sponsors when they have come up with such results. Conventional modelling commissioned by the Warburton Review concluded that a stronger RET would lower wholesale power prices. The economics of that conclusion comes from the way in which wholesale prices are formed in the National Electricity Market. The Renewable Energy Target or an Emissions Intensity Scheme or a Clean Energy Target, or any baseload and credit scheme including the emissions reduction component of the proposed NEG, mandates a certain level of emissions reduction. It requires generation that exceeds the specified level of emissions to explicitly or implicitly purchase credits from generators which exceed requirements. That transfers income from established high emissions to new low emissions generation. It therefore encourages more investment in the lower emissions generation activity. Renewable energy bids into the electricity market at a very low, a zero or even a negative price. The general rule is the more renewable energy in the portfolio, the lower the average price.

Beyond the analysis of the Renewable Energy Target, conventional modelling of the Clean Energy Target for the Finkel Review produces a similar result. Allen Finkel had the Jacobs Consultancy model the respective effects on wholesale prices of the Clean Energy Target and an alternative, an Emissions Intensity Scheme. You have got to dig into the modelling a bit to understand why the Clean Energy Target leads to lower prices than an Emissions Intensity Scheme. Ultimately, they get that result because the Clean Energy Target would be associated with more growth in renewable energy than the Emissions Intensity Scheme.

There is a brief reference to the tendency for higher proportions of renewables to lead to lower wholesale prices in the ACCC review.

The Thwaites review draws upon really interesting empirical research. It documents extraordinary blowouts in retail costs and margins, and how that has a disproportionate effect on low incomes. It

draws attention to pernicious effects from non-transparent, incomprehensible ways of making offers into the market.

The most recent in the line of reports is the Energy Security Board's letter to the Commonwealth Energy Minister. The ESB was responding to a request for advice on how to secure reliability in energy supply consistently with meeting international obligations to reduce emissions, all with the lowest possible price of electricity. The main focus of the request and certainly the main focus of the eight-page response is on reliability.

In that letter, the Energy Security Board recommends the introduction of a National Energy Guarantee (NEG). Although it is talked about as one instrument, a NEG, it's actually a NEG's because separate obligations are required for reliability and emissions. The reliability requirement is specified as a specified proportion of "dispatchable" power. The proportion varies across regions. However, we know from the sophisticated work of AEMO and of the Melbourne Energy Institute for the Finkel Review that a single instrument cannot secure reliability. A whole lot of grid stability services are necessary. If you try and bundle those together in one instrument, you are not going to provide incentives for provision of the range of grid stability services that are necessary for reliable and secure power supply. Multiple reliability and security instruments are required, so at very least we have a multi-NEG's.

The NEG or multi-NEG's places an obligation on the retailer or the large user to comply. In this, the NEG is similar to the Renewable Energy Target, which is administered by the Clean Energy Regulator. The NEG proposal requires the regulator, in this case I presume that it would be the Australian Energy Regulator, to inspect forward contracts to establish that the retailer or the user of power has purchased contracts that on average have the necessary mix of dispatchable power and emissions. There is ambiguity about what qualifies as dispatchable power. At one point, there is a suggestion that coal could be dispatchable power.

The ESB letter notes that there will be no carbon price but that enterprises can trade under-the-counter contractual unders and overs. There's no explicit or transparent carbon market or carbon price, but there is a hidden or implicit carbon price.

The ESB letter proposes that its recommendations be considered by COAG by late November. This timetable seems likely to be disrupted by the Queensland election. The letter suggested that the emissions part of the guarantee could be implemented from 2019 and the reliability part from 2020. The ESB proposed that the South Australian Parliament legislate the new arrangements first, with other member states and Territories of the NEM following. That was the legal process through which the NEM was originally introduced. The ESB letter suggests that the recent history may make it useful to implement the program first in South Australia.

The ESB letter indicates that there will be a requirement for a proportion of so-called "dispatchable", energy. It's not clear what other requirements on reliability will enter that part of the NEG. It indicates that the requirement on dispatchable energy will be required to cover a proportion of the estimated peak load, and that proportion will vary from region to region. At some points, it talks about flexible dispatchable power, but at others it talks about dispatchable in a way that's conflated with baseload.

The letter does not recognise the range of different differentiated stability services that AEMO and the Finkel Review have identified.

On the emissions part of the NEG, the letter does not mention a target, but says that is for governments to determine. There have been suggestions that the ESB has in mind the electricity sector reducing its emissions by just 26 to 28% from 2005 levels—corresponding to the initial “holding commitment” to reductions in emissions for the country as a whole. This is generally seen as a low target given other developed countries’ commitments. Certainly a low target is implicit in the low renewable share that it estimates will result from this. In fact, given the strong momentum in behind-the-meter growth in solar PV, the letter suggests that there will be virtually no expansion of large-scale solar or wind in Australia through the 2020’s. A radical deceleration of rates of investment in large scale renewables. That’s implicit in the numbers that are presented there, and interestingly it says that whatever the targets are the retailers and the users should be able to meet these targets by drawing from either domestic ACCU emissions credits or international credits.

The ESB own assessment of the NEG’s impact on prices says that everyone agreeing that this is the right way to go will end uncertainty about reliability and emissions obligations. Everyone agreeing on policy would reduce uncertainty and the supply price of investment in new generation, and new generation would lower prices. All of us agreeing on anything would lead to greater certainty, but I think it’s actually unrealistic to expect to get consensus in the community about anything that does not face up realistically to our international responsibilities on reduction of carbon emissions. The letter says that the price reduction will be greater than it would be from the CET or the RET or the EIS, it says the introduction of the NEG will reduce residential prices by 100 to 115 dollars per annum and it says that wholesale price will fall by 20-25% per annum. That last statement must be a mistake... that’s what the letter says.

I’ve got a number of questions about the reliability and contract markets and how these would be affected by the NEG. I can’t see how the reliability part of the NEG will actually work. It doesn’t mean to say there’s no way it could work, just that there’s not enough information there to actually know.

I’ve got a question about whether the overlay of contracts in the energy only market with multiple reliability requirements would destroy liquidity in forward contract markets. We’ve got a pretty good forward market for contracts, that a new retailer who doesn’t own any generation can go to. If you change that market so there’s not just a market for megawatt hours for power of energy, it’s all mixed up with a whole lot of other obligations, I can’t see how that wouldn’t damage liquidity in a forward contract market. I think there are issues with the absence of competitive transparent markets for reliability services and emissions. The letter is careful to say there will be no carbon price, which means there will be no transparent market, and there will be no discoverable emissions price. The absence of transparent pricing is presented as a virtue, but is a problem. A less liquid and less transparent forward market would strengthen the large retailer oligopoly—the present strength of which is seen as the cause of high prices by the ACCC and the Thwaites Review.

The strengthening of the oligopoly caused by the absence of a transparent emissions market would be compounded if large coal generation owned by large retailers was redefined as flexible, dispatchable power and accepted as meeting all reliability requirements under a NEG. The ESB letter at one point but not others problematically conflates baseload and flexible dispatchable power.

These are not irretrievable weaknesses of a NEG. WE could turn the NEG into a multi-NEGs and remove the problems. The NEG would have to be an umbrella covering the multiple competitive, transparent markets envisaged and being implemented by AEMO, as well as a separate emissions

intensity guarantee. While a well designed multi-NEGs remains a possibility, it would not be responsible to say the NEG can't work effectively. But until the NEG has been redefined in this way, it would not be responsible to proceed to introduction of the NEG. The effects of the NEG or the multi-NEGs would depend on its final content.

I see the implementation of the NEG proposal through the placing of obligations on the retailer or large power user, analogously with the RET, as positive in relation to the emissions reduction obligations—so long as there is a transparent market for unders and overs on emissions intensity. Placing the obligation on the retailer or large user could be problematic in relation to the multiple reliability obligations, as it would complicate and maybe block AEMO's building of multiple grid stability markets. The problem would be removed by placing the final compliance obligation on the retailer or power user, but having the retailers meeting that obligation by drawing on transparent markets for emissions and multiple grid stability services.

The ESB letter raises questions about the effect of the NEG on prices. The assertions about the effects of renewables on wholesale prices are inconsistent with the conventional modelling and the economic analysis. The conventional modelling and analysis says that when you transfer income at the margin from a high emissions activity and use it to promote investment in renewables you'll get more supply at zero marginal costs or even negative marginal costs bidding into the market. This is likely to lower wholesale prices.

Reliability has a cost that is not recognised in the letter. The ESB has failed to meet the Productivity Commission's first requirement: to recognise the trade-offs amongst reliability, price and emissions reduction objectives.

The letter errs in making statements about changes in retail prices without addressing at all what have been the two main sources of upward pressure on prices to electricity users through the twenty first century: the networks; and the retail oligopoly. Neither of these is affected by the proposed NEG.

The ESB's statement that wholesale prices will fall by 20-25 percent per annum cannot be meant to mean what it says.

We've had one market test about whether the NEG will reduce prices, and that's what's happened in the forward markets since the announcement of the NEG and since October 17. I just looked up Victoria. The Victorian forward price for 2020 has increased by \$1.50 per MWh since the announcement. The markets aren't expecting the NEG to reduce wholesale prices.

The questions about how the NEG or multi-NEGs works for reliability are of a technical kind, and could be worked through to a satisfactory conclusion if all involved were committed to an efficient outcome. The NEG's role in relation to emissions reductions requires some harder thinking. Nevertheless, there is a way of reconciling apparently irreconcilable positions if we have a mind to do so. I suggest a path to reconciliation here.

The ESB letter itself says nothing about the appropriate extent of emissions reductions. It leaves that to Governments—by implication to COAG and its members. However, subsequent discussion suggests that the Commonwealth thinks that reduction of electricity sector emissions by 26-28 percent by 2020 will be satisfactory. There has been some suggestion that this would be consistent with our commitments under the Paris agreement within the UNFCCC.

What are Australia's commitments under the Paris Agreement? We have agreed with all members of the United Nations—not yet excluding the United States, although the Trump administration has signalled an intention to withdraw—to contribute our part of a global effort to hold global temperature increases below 2 degrees and as close as possible to 1.5 degrees. The G7 leaders in Berlin said that to meet 2 degrees, all developed countries would need to achieve zero net emissions in electricity by mid-century.

We have explicitly committed to reducing emissions by 26-8 percent by 2030, and to participate in an international process of strengthening this commitment between now and 2030.

Let us look narrowly at the minus 26-8 percent by 2030. All detailed studies of the lowest cost path to reducing Australian emissions have concluded that electricity emissions must fall much more rapidly than total emissions. This began with the modelling I did for the original Climate Change Review back in 2007 and 2008 (Garnaut 2008). Similar conclusions emerged from The Climate Change Authority's work, the Australian Treasury's work, The Department of Industry's work, Climate Works study of paths to zero emissions in Australia. The Commonwealth Treasury with the Department of Industry, Energy and Environment published the results of detailed modelling in 2014, which demonstrated that lowest cost paths to low emissions in Australia required faster reductions in electricity than in other sectors. These studies showed that to reduce emissions 26 to 28% in the economy as a whole, electricity emissions would need to fall by around 50 percent.

Reducing electricity emissions by half by 2030 is necessary under a minimal interpretation of our obligations under the Paris agreement. That's not ruled out by the ESB's letter on the NEG. But let's be clear. Such a commitment has to be ruled in, or meeting our Paris commitments is ruled out. Logically we could start slow and finish fast in our movement to zero net emissions. If starting weak and finishing fast will have a cost—and at some point a prohibitively high cost.

The ESB letter, like the Finkel Report and the Productivity Commission Review, notes the importance for policy stability and therefore to incentives for investment to have consensus around emissions reduction targets. It is fantasy to expect consensus around a weak target—simply because a very large number of Australians are well informed of the realities of climate science and diplomacy and take the issue seriously.

I suggested in July in a public lecture on the Finkel Report, that we do not try to bridge the gap through compromise between people who believe that the science of atmospheric physics is wrong, and people who are part of the international commitment to mitigate climate change. That's too wide a chasm to bridge.

My suggestion is to adopt two targets. One is weak, to satisfy the vector of forces which determine outcomes in today's Coalition party room. The other is a stronger target, that is consistent with our meeting our Paris Agreement commitments. The first would have electricity emissions falling by 28 percent on 2005 levels by 2030 and continuing on a similar linear trajectory to zero by about 2070. This is the target that was modelled by the Jacobs consultancy for the Finkel report. The second would have emissions falling by 50 percent by 2030 and to zero in about 2050.

Whether we followed the weak or the Paris trajectory would depend on prices in the wholesale markets. The most politically influential arguments against a strong emissions target is that it will raise electricity prices. I've suggested that we follow the stronger path, the Paris path, if accumulated average wholesale prices from a base year—say this year, 2017--have fallen by 1% per annum.

If the conventional economic analysis is correct in concluding that higher rates of growth in zero emissions energy supply promoted by some baseload and credit incentive scheme would lower wholesale prices, we will stay on the Paris trajectory. However, if the alternative view that stronger renewable energy-encouraging policies will raise prices turn out to be sound, we will stay on a weaker emissions reductions path.

I do not expect that my proposal would end the debate. But it would end the policy uncertainty if enough people in the independent centre of the polity decided that the proposal gave us the best possible chance of realising their own objectives.

The two-trajectory approach would end the uncertainty in a way that was consistent with maintaining strong incentives to invest in renewable energy. The incentive to invest is determined by investors' expectation of the value of the sum of wholesale prices and renewable energy or CET or equivalent credits. Under the two-trajectory approach, expectations of lower wholesale prices would be accompanied by stronger emissions reductions targets and correspondingly higher environmental credits.

Powerpoint slides 29-32 of the attached presentation describe the shapes of some possible trajectories. In chart 29, The trajectories modelled by Jacobs for the Finkel Review is in red. The Climate Change Authority's pre-Paris assessment of what is necessary to do our fair share in a global commitment to hold warming to 2 degrees is in turquoise--54% reduction emissions by 2030, 100% by 2046. With some fine tuning following the Paris meeting, these could serve as our Coalition and Paris trajectories.

Chart 30 presents the results of modelling the relationship in various developed countries of the relationship between total and electricity emissions reductions within a minimum cost scenario. The modelling reveals that it is much cheaper to reduce emissions in electricity than in other sectors, so if you want a low-cost path to zero emissions you do more on electricity first. Decarbonisation of electricity and electrification is also the low-cost path to decarbonisation of other sectors, including transport (the electric or hydrogen car) and industry (electricity replacing coal or gas as a source of heat, renewables-based hydrogen to replace carbon in nitrogen fertilisers and iron oxide smelting and so on). Chart 30, simply plots the relationship between total and electricity reductions within Australia defined by the Treasury and the Department of Industry, Climate Change, Science and Energy in 2014 (the heavy circles). This relationship is similar to that discovered for the whole of the developed world by modelling for the OECD (the light circles).

One other matter related to the ESB Letter's discussion of emissions needs to be discussed. The letter suggests that liable entities should be able to utilise some domestic and international credits to acquit obligations under the NEG. It would be imprudent to presume that international credits under the Clean Development Mechanism (CDM) will be available in 2030. I was part of the UN panel that reviewed the CDM three years ago. At that time, the UNFCCC chose to constrain and truncate rather than reform the CDM. There are surplus credits to be used up in the near term, but once they are used up there will be no supply of new credits. Other international credits can arise out of trade through other windows of the UNFCCC system. The UNFCCC and trade counterparties would have to recognise the legitimacy of our system. During 2013, the European Union accepted the legitimacy of Australia's carbon pricing system and agreed to trade between the Australian and European Emissions Trading Systems. That would have all begun from the middle of 2014 if the Emissions Trading system had not been abolished. However, it is not a foregone conclusion that the potential international counterparties would accept trade in NEG instruments. At the moment the credible counterparties would be the European Union trading system and the Californian trading

system. One day perhaps these will be joined by the Chinese trading system, but we will have to see how the Chinese trading system works out. I can't imagine the European Union or the Californian systems accepting the legitimacy of carbon credits generated within the mechanisms that are described in the ESB letter on the NEG.

Domestic credits--Australian carbon units--were generated by the carbon farming initiative. They involved double counting unless the sector generated the credits from over-performance against comparable targets, or unless the sector generating credits is part of the whole economy for which emissions reduction targets have been set. If the land use sector is generating credits --carbon sequestered in soils, pastures, woodlands and forests -- for use in the electricity sector, then you can't count those carbon credits as reductions in emissions from the land use sector. You need to treat the land use sector and the electricity sector as one source of emissions, and calculate reductions in emissions across the sectors together. You are double counting if you are saying that we are reducing land use emissions, and that we are meeting our electricity emissions reductions by buying credits from the land use sector. This important issue wasn't addressed in that short letter from the ESB to the Minister.

Finally, the few words in the ESB's letter that relate to South Australia need updating. This is quite important in the Australian debate. South Australia through the efforts of AEMO and the South Australian Government, have dealt with the short-term reliability question. In the longer term, there is a need for multiple transparent competitive markets for emissions and reliability services. In the advanced high renewable energy sector that SA electricity has become, South Australia needs the same as other states—but needs it now. There's more time in other states.

There is one more interesting point to be made about recent developments in SA. South Australian wholesale spot electricity prices are coming down as renewables expand. In the past, South Australia always had much higher electricity costs than NSW or Victoria or Queensland, essentially because it didn't have the rich coal resources of those states. During the first two years of the National Electricity Market, 1999 and 2000, the electricity wholesale price in South Australia was more than twice as high as in NSW and Victoria. That was the starting point of the NEM. In the last decade, average wholesale prices in South Australia have been about a third higher than Victoria, and about a quarter higher than NSW. If you just take this financial year, since July 1, South Australia spot prices have actually been a touch below Victoria and NSW. That's a historic reordering of South Australia's position. South Australia is mostly renewables these days and coal still dominates NSW and Victoria. Perceptions are a bit out of date on the question of South Australian relative to NSW and Victorian spot wholesale prices. When you look at the forward contract markets, South Australian price is still higher than the eastern states. That's a result of the oligopoly having greater control of prices in SA. That is a different problem. All of this data is from the AEMO data dashboard.

For the NEG to provide a basis for policy stability with energy security, low costs and low emissions, it will be necessary for it to provide an umbrella which can provide shelter for AEMO's multiple transparent grid stability service markets, and for realistic Paris targets. If we are able to provide for this, we will have laid the foundations for Australia's emergence as the energy superpower of the low-carbon world economy.

If Australia as a whole is unable to provide these conditions, WA need not be dragged back. WA can establish itself as an energy high productivity island. To achieve that outcome, WA would need competitive retail and generation markets and cost-reducing network management to minimise costs. These would need to be supported by multiple competitive grid stability service markets.

WA has parts of the foundations in place. It lacks other parts—some of which are so far better developed elsewhere. It has a form of reserve capacity market, which is required all over Australia. It has the domestic gas reservation that has retained the availability of gas peaking to balance the expansion of renewables. Build on these, add new markets, and WA can move ahead quickly to establish itself as a preferred place for investment in energy-intensive industries. Do it well, and this could provide a model for later reform of the National Electricity Market.

So, if the rest of Australia continues to wallow in incoherence, take that as an opportunity. Work it out yourselves. Give the western third a competitive advantage. Eventually WA will have to compete for business in Australia, the energy super power of the low-carbon world economy. But for the time being there is an opportunity to get ahead of the eastern states.

Question and Answer

Alistair Leith from Yes to Renewables:

You referred to the Paris Agreement a few times Ross, and there's a lot of interpretations of what that means going around. There's 2.0 with an aspiration of 1.5. There are Australian commitments already made, and there is a possibility that all nations will ratchet those commitments up over the next few years. So I'm wondering what you refer to when you say Paris Agreement. I draw your attention to Kevin Anderson, Deputy Director for the Tyndall Centre for Climate research in the UK. He says the climate budget to get to 2.0, if you give India, China etc, to 2050; that means full decarbonisation in rich countries by 2035. Basically a 10% per annum reduction.

Very important question. We've all made a commitment to Paris, now including even Syria which took a while. The US is seeking to withdraw, but the US hasn't yet withdrawn. We have all agreed on taking what action is necessary to hold temperature increases below 2 degrees and as close as possible to 1.5. The agreement does embody a commitment to propose initial national targets, and then to ratchet them up over time. That last element of the agreement is a personal initiative of the US President Barack Obama and I think was a very important part of the statement. Now if someone like Obama was there, then that would help early momentum to strengthen commitments. With Trump representing the United States then the dynamic will be different. We have to recognise that difference for the time-being. But the Paris accord embodies recognition that the first set of targets, first set of commitments, won't get us to the under 2 degrees and therefore that we'll have to ratchet up over time. That's part of the agreement. Australia put on the table 26 to 28% by 2030 without saying what we'd do by 2050. The international community has mostly seen Australia's as a weak commitment, even weaker than the United States for example. The US has 26 – 28% reduction, same numbers, but they'll get there by 2025. Another data point is the G7 meeting in Berlin just before the Paris meeting. The G7 agreed that developed countries would need to go to zero emissions in electricity by the middle of the century. So that's another data point for us. So I look at all of that and say at the very least we have to get the 26 – 28% on all emissions by 2030, and to zero by the middle of the century. The latter number is also consistent with the Climate Change Authority's careful work released in 2014. So that's what I mean by the Paris Commitment.

Ben Rose from Sustainable Energy Now.

As you say Western Australia already has many of the features that you suggested. We're not reliant on the spot market and we have a reserve capacity mechanism that ensures reliable, dispatchable back-up generation. My question to you is would it not be a good thing for governments to own the fleet of open-cycle gas turbines that will be essential for backup, our modelling shows that, and which if they were government owned could provide that dispatchable energy at about 250 -300 dollar maximum per

megawatt hour. Thus ensuring stability of the grid and then you contract out through your so-called competitive market which I suggest to you should be a long-term reverse tender power purchase agreements for renewable energy.

Should government own the reserve capacity? I think a case can be made for that. You need to separate it out from the normal energy market, like South Australia did. In its 2016 Energy Plan, the South Australian government, said it would just put in place 250MW of generation for the next two summers, because it sees that as the emergency time before other mechanisms for balancing come in. It need not only be open-cycle gas, that's one technology, Malcolm Turnbull has given high profile to pumped hydro storage, notably 2 gigawatts from the Snowy. For that really to serve the purpose of stabilising the grid, the reserve capacity would need to be held in reserve and not traded by Snowy Hydro all the time in the market. I think there is a case for the Commonwealth to own that and to hold that capacity in reserve to stabilise the grid. You've got strong transmission out from the Snowy system into New South Wales and Victoria, and this could be strengthened. The grid is weaker from the Snowy into Queensland, South Australia and Tasmania. But at least in those two big states, you could get quite a lot of the way to the necessary stabilisation through the Prime Minister's pumped hydro storage. In WA, at this stage, maybe it should be open-cycle gas but that's not the only possibility and there are pumped hydro opportunities here. We can work that out over time. But I think there is something that can be said for government ownership of the necessary reserve capacity.

I would just like to enquire on your thoughts where you seem to be working financial metrics. The human mind grows with wisdom by caring. But right now we keep using money, we've come out of an industrial economy into a knowledge based economy and it can produce the surplus if we do things properly. But we're not focusing it all on the habit of people, we're just trying to meet the demand, rather than empower people to say which in the end, they get habits that are less wasteful, and we get less pollution out of it. Shouldn't we be bringing in a philosophical aspect to the decision making on our energy management.

Yeah I think that we can usefully put more emphasis on energy efficiency, energy conservation. At a private level a lot of Australians are doing that and that's one of the reasons we've seen no growth in total electricity demand in the grid through the last 10 years, even though population has increased by over 1.5% per annum through that time. As a totally community, a national community, we're making progress and part of that progress is what individuals and groups have done to elevate the priority of conservation.

It seems likely that we'll have a change in the National Government within the year or so, are you optimistic that there will be any real difference?

Well the ALP went to the last election with quite different policies to the Government, that were stronger on reducing emissions, and they've stuck to that under a fair bit of pressure. I noticed that last week the Opposition spokesperson on climate reiterated those positions in a careful commentary on the NEG. When you carry as many battle scars as me optimism doesn't come easily... but there's a chance.

Brad Pitt From the City of Fremantle:

One of the challenges of Western Australia is of course we almost have too much power on our grid at the moment making the transition to renewables more difficult. We've had great success in individual rooftop solar, but in terms of actually broader large-scale renewables, in the amount of dirty power we still have dominating our grid. What would you say to our state government as we try and make that transition,

because it seems to me that there's not any clear leadership on that at the moment and no transition on the horizon.

I think it would be an advantage for the State to have competitive access to a wholesale market. Here when you've got a couple of big state enterprises really dominating purchase of power, and not real competition, it's rather hard for a new generator to break into that. I think it would be useful to remember some elementary economics in managing efficiently an electricity grid. The network is a natural monopoly. Privatising a natural monopoly is highly problematic. You need complicated, difficult, regulatory systems to manage price without encouraging wasteful over-investment, or leaving the network undersupplied with capital. That's *hard*. Not impossible, but we haven't done it well in the National Electricity Market. You can have in principle genuine competition at the generation and retail end. Now, again, the Australian experience with the National Electricity Market hasn't gone too well. But I think there are lots of advantages from private ownership and competition in generation and retailing--in promoting innovation, new sources of supply, introduction of both solar energy storage and new approaches to supplying energy. It only works if you encourage competition. The ideal is a competitive generation market in which private suppliers of large scale renewables can bid and new retailers focusing on renewable energy supply can participate. In such a system, WA would have access to some very low cost electrons. The cost of renewables is now so low that I would imagine, I haven't looked in detail for WA, but I would imagine that the cost of the electrons is a good deal less for large scale efficiently installed solar, than for the gas alone for a gas generator. You also have some high quality wind resource-- eg the west coast from Greenough to Geraldton. The first step would be to have day-time production of the renewables and then using the gas-generators over-night. Later you go further. One other thing. Whatever happens in a national context, if West Australia put in place an emissions intensity scheme, or a clean energy target or a renewable energy target that imposed an obligation on all retailers, and if that obligation could be met by purchasing credits from renewable production, you would get a faster transition and you would get lower energy costs in the wholesale market.

Paula Sampson from Citizen's Climate Lobby

You mentioned that the Australian Productivity Commission has said that a price on carbon is necessary. How important, in your opinion, how important are community groups in contacting members of parliament in their own electorate – at home, to discuss this with them and to try and move them towards the thinking of the necessity of a carbon tax.

That's an important part of the process. It would be naïve to think that we're going to have a broadly based carbon price again any time soon. We had a good one from 2012 to 2014. It actually had all of the effects that it was supposed to have. Electricity emissions fell by I think around 8% in the two years in which the carbon price was operating. It did increase some prices, electricity prices, but the revenue that the government gained from carbon pricing was used to fund tax-cuts for low-income earners and middle-income earners and social security adjustments. As a result, nobody on low or middle incomes lost any of her standard of living as a result of those higher prices. We're all familiar with the political attack that was made on that very environmentally and economically efficient system of carbon pricing. That history means we won't be going back to that very soon. So the practical debate about what happens next is not about that. But in the longer term we're going to need broadly based carbon pricing. The long term...well that's a time scale on which everything that is really important happens.

Piers Verstegen from Conservational Council Western Australia

Thanks for your lecture. Your vision about Western Australia becoming highly competitive in the clean energy market globally is compelling and I think you started to touch on this in your previous answer but I wonder what sort of policy instruments would the West Australian Government consider in your view that

would help us get there. Noting that I think at the moment Western Australia is the only state without either a carbon reduction target or a renewable energy target. I understand that a renewable energy target is taken off table by comments that were made by the Premier during the election campaign. I wonder if you had a view on that. The other question I wanted to ask was it seems like from what you're saying that more recent modelling shows pretty clearly that there's been an inflection point when introducing more renewable energy into the system will drive down energy prices. When do you think we're going to see an inflection point where the major industrial energy users of this country start to understand and advocate for that?

Well on the last point, I chair the board of a renewable energy company, ZEN Energy, which has just been taken over by one of Australia's biggest industrial users of power, Liberty OneSteel, because they want to reduce their power cost by using renewable energy. So at least that inflection point has been reached, and I think we'll see more and more of that sort of thing. You said 'what could the WA Government consider', well I don't know what they could consider. I suggest that we suggest that they consider what I said in my last answer, that we have a state based baseload and credit system which could be based on an emissions intensity scheme or a clean energy target or a renewable energy target. I myself would prefer an emissions intensity scheme, of the three. It could be administered in the same way as the Commonwealth' renewable energy target. Now you said that WA didn't have a renewable target. In fact, WA is part of the national renewable energy target. So you do get incentives from the nation renewable energy target. You also said that WA doesn't have its own renewable energy target and other states do. One has to be careful by what's meant by this - the other states have got targets but no mechanisms for getting there. What actually matters is the instruments you put in place to get there. That's what I'd focus on. In the case of South Australia they've had a very ambitious target to get to 50% renewables by 2025. Now they're already exceeding 50%, but the drivers were not especially anything that was put in place by the SA government. It's just that South Australia was the best place in the National Electricity Market, the lowest cost place to put in renewables so the national incentives have a much bigger effect in South Australia than other states. So let's focus on the actual incentive rather than the target itself. The type of incentive that's worth considering is the state based system of the kind I've mentioned, which is likely to reduce rather than increase power costs. Any market based system like that is only going to be effective if you've got a competitive generation market and we're a fair way from that, so that's another set of reform. That's a set of reforms that's worth considering, because it will bring with it more scope for private initiative which will allow things to run much faster.

