

**RESUMED**

**[2.01 pm]**

30 COMMISSIONER: We'll resume day three and I welcome Prof John Quiggin who was to be part of our first session on climate change but the technology was too much for us. John, you're very much welcome. Mr Jacobi.

35 MR JACOBI: I'll introduce Prof Quiggin again. He's an Australia Laureate Fellow of the School of Economics with the University of Queensland and has been since 2003. Prior to that he has held an academic position at a number of Australian universities – the ANU, University of Sydney, James Cook University as well as the in the United States the University of Maryland. He is a member of the Climate Change Authority. He is among the top 500 economists in the world according to the IDEAS RePEc and is best known for his work on utility theory. We call Prof Quiggin to the commission.

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45 COMMISSIONER: Professor, if I can start – we will get to climate change but I'm interested in your submission for which I thank you. In that submission you talk about a time frame for establishing nuclear power. It may well start in 2016, should we so recommend it and it seems a power plant being constructed in 2030 to 2040 – I'd characterise this as a business as usual time scale. I'm

just wondering whether you see anything that might be imminent that would change the motivation for the sort of time frame that you identify.

5 PROF QUIGGIN: Well, maybe jumping to a question that might come up later, of course certain kinds of policies, states could manage this on a much faster basis. France did so in the early 1970s. China, although they are, in fact, playing down nuclear a bit, China is capable of doing it. What you need are a set of characteristics, a very centrally controlled technocratic government, not too much democracy and local process, so certainly not too much concern  
10 about things like residents' objections and that kind of thing, not much concern about issues like competition policies.

15 So what France did was say, "We're going to pick a standardised design and we're going to put the plants here and here." The French technocratic elite was then at its peak, their whole rationale was from people like that, so they could do in the 1970s a very rapid transition to nuclear based on a single central decision taken with essentially very little debate. Obviously, of the countries proceeding with nuclear and having some success, China has done the same.

20 So if we could reproduce those conditions in Australia, make everything a federal system, not have any kind of environmental procedures, the kinds of things where we see a delay in coal projects, for example, and could have a centralised agreement between the major parties that we were going to pick a particular contractor, stick with it and push it through at great speed, we could  
25 go faster than that timetable I've suggested. But in the actual conditions we say that timetable, in my view, is highly optimistic, I think. I think the time I've allowed is far shorter than perhaps would be the case if we attempted to go nuclear.

30 COMMISSIONER: Do you see any external factors driving us down a potential to shorten the sort of time scale that you've identified?

35 PROF QUIGGIN: Honestly, I don't. I believe that there's a risk that we'll simply stay in the kind of policy paralysis we have at the present, but assuming we don't I think we'll go back to carbon pricing and we'll go down essentially a renewables based route that's an already well-established industry. With popular acceptance – there's obviously a little bit of objection to wind but broad popular acceptance and essentially all we need is the price signal and some policy certainty and that's the path we'll take.

40 COMMISSIONER: We might go into some of the areas of your submission, but I'm interested in what your view is of the event that we expect in Paris at the end of the year and what signals you think the world might send from that meeting and the consequent action that might come from that.  
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PROF QUIGGIN: I think the outlook is reasonably optimistic. I think if we go back to Copenhagen five years ago, on the one hand the expectations were too high, and on the other hand we had powerful parties – China most obviously but to some extent the US and India – all much more concerned with preserving their own freedom of action than with moving forward and much more concern about the economic impacts of the policy.

So I think we now see that the US and China in particular are both committed to doing things but we'll certainly have a bun fight about issues of whether it's legally binding and those things but I expect to see from the indicia of commitments we've seen so far a set of commitments which, while they're not on the optimal path to a degree of 450 parts per million solution, will keep us within reach of that path and I expect the path will be back again in five years and 10 years' time, gradually upping the ambition. I think under that scenario we can indeed reach 450 parts per million but we'll probably still be arguing about it right up till 2050 or thereabouts.

COMMISSIONER: So you think even with this gradual approach 450 parts per million by 2050 with zero emissions is within our scope?

PROF QUIGGIN: It is. It's not the optimal path. That's what economists have said about it. If we had all the information we needed to act 15 years ago we could have started then and we would have done it so much more cheaply, but the costs are still modest in terms of a growing world economy and I expect we'll achieve it, yes.

COMMISSIONER: If I could go back and then I'll ask Mr Jacobi to take over. So is the issue that concerns you with time frames social licence, predominantly?

PROF QUIGGIN: Well, it's a bunch of things. Social licence is part of it but I think that focuses too narrowly on the kind of what might be called the NIMBY objections of people who don't want nuclear power stations next door. Processes simply like setting up a regulatory framework are very complicated. If we look at – even assuming that there was general popular goodwill out there, we still have to have the procedure of selecting sites. That's something that hasn't been done in the Western world for many decades. All the existing power plants being built in the US are being built on brownfield sites next to existing nuclear power stations.

So we have to have a procedure of some kind to select locations and design procedures, finding the people to do it, setting up all the things that need to be thought about with a nuclear power station. That's inevitably going to take a great deal of time, even assuming popular goodwill, which of course is a pretty heroic assumption.

COMMISSIONER: It is if the world doesn't accept a view about climate change and its impact.

5 PROF QUIGGIN: Well, I think even so. I think the majority view will be that  
renewables can do the job and should do the job. I think it will be hard to  
persuade a large proportion of the population that nuclear is superior to  
renewables but we won't see a substantial position. But, as I say, even in these  
10 US locations where there hasn't been any significant issue of social licence in  
the sense we're talking about it, there's still major regulatory complications,  
disputes about the price. So if there have been cost overruns then there are  
disputes from consumer groups, of course, informed by concerns about  
nuclear, saying, "We shouldn't have to bear these costs," and disputes between  
15 parties, all of these things which are in broad terms under the heading of social  
licence, and led to very substantial delay.

So if we look at the US nuclear renaissance program they were starting in  
2002, hoping to have plants online by 2012, and a lot of them instead will be  
20 lucky to get four plants online by 2020. That's without any significant element  
of protest. There hasn't, as far as I'm aware, been any public protests of any  
significance at the nuclear power plants that are under construction in the US.  
Obviously concerns have been expressed about the regulation process but there  
haven't been activist protestors. Nonetheless, a process that was supposed to  
take 10 years has taken 20.

25 COMMISSIONER: The commission has been to the UAE to have a look at  
their four build sites there. They're certainly a different democracy, as you  
point out.

30 PROF QUIGGIN: Yes.

COMMISSIONER: But they have developed a regulatory framework and  
despite, I think, what you allude to in one of your articles, they've managed to  
bring that expertise into the country to develop that and depending on who you  
35 read, they probably delivered their first reactor within 10 years.

PROF QUIGGIN: Yes. Honestly, I mean, UAE is another example, I guess,  
of the kind of jurisdiction that could do that kind of thing. As I say, I simply -  
even if we had popular goodwill, there's no way that - yes, there's no way, I  
40 think, in the Australian context that we could do the kind of things the UAE  
does.

COMMISSIONER: I accept it's a different environment, but I'm really talking  
about trying to understand your approach, which appears to me to be a serial  
45 approach to the activities, and that's based upon largely, from what I can see,

the US experience you had in terms of the challenges with the environment.

PROF QUIGGIN: There are some parallel elements. I have attempted, in drawing up the time scale, to do as much as I thought was feasible in parallel.  
5 It's largely based on the US because the US is the most favourable. If we look at France, for example, which historically was of course hugely successful, we have the phenomenon of negative learning by doing that. Successively as the conditions of 1970's France have disappeared, French nuclear power plants have become more and more expensive. The Flamanville plant is way overdue  
10 among other things, and this certainly is obviously going to be an issue in the Australian context. They went from a commitment to use foreign supply in the 1970s, an American supplier, because they were the cheapest and fastest, to having a French supply.

15 So the Australian context, for example, as an issue of social licence, it's very different. The obvious question, if a nuclear power plant were to be built in South Australia would be, is South Australia going to get any work out of this. The answer should be no. The answer should be, "No, we will hand over to the American firm that would construct the thing and they'll make their own  
20 commercial judgment with no pressure to use local suppliers. They will construct it in a way that is most efficient for them." I assume that's pretty much what's been done in the UAE, and so that kind of issue, I think, reflects the kinds of factors that I'm talking about in the delays in the process.

25 COMMISSIONER: I would have to say that the UAE, presents a different case from that, and there are several things that make no sense for a new country going into nuclear to construct, but there's a lot more that they can do, and I guess that will be part of the commission's work to try and establish what realistically can be done in a country where local communities and the local  
30 state gets benefit from it, and I should also make the point that Korea has just selected the green field site. Again a different environment, but it certainly has occurred. I see also that you think the AP Westinghouse 1000 is the only technology we should consider.

35 PROF QUIGGIN: Yes.

COMMISSIONER: Could you just expand on it?

PROF QUIGGIN: So if we go back to the Swokowski report, which was  
40 moderately enthusiastic about nuclear, one of the points he made was that we shouldn't do anything just at the moment, and obviously I take that not to mean literally the first, but that as a country with no experience in managing and dealing with this kind of technology, we want something with an established track record, operation, a reasonable number of projects completed. If we also  
45 want a mature and modern technology, Generation III+, as opposed to the kind

of obsolete technologies which are based on Generation II in the 20th century, we have fairly small number of possibilities, and in my view, the likelihood that any of those are going to be developed on a sufficient scale by the time we make a decision on times that we're talking about is quite small.

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I don't see a CANDU or EPR going that way. I don't think in any conceivable context that a Russian supplier, for example, would be acceptable in Australia, and so that, I think, we can rule out, and I think the same is probably true of the Koreans. So in my view, if we want something which has by 2025 a reasonable number of plants in operation and assuming favourable conditions of nuclear are much more under construction, I think that's the only likely end.

COMMISSIONER: You dismiss the CANDU reactor?

15 PROF QUIGGIN: I can't see that there are going to be any significant number. There are none under construction right now, to the best of my knowledge. So I can't see how by 2025 we would have any scope. That would be an ideal case of Australia going for a first-of-a-kind technology.

20 MR JACOBI: I think just to come back to an issue we were discussing at the start, which was the nature of the French program in the 1970s, one of the issues which I want to give you an opportunity to comment on, whether there were any particular labour force characteristics that existed at that time in France in the 1970s and whether there's any relevant parallel to Australia now.

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PROF QUIGGIN: Well, certainly, as I say, the - I don't know much about the construction work or the development but obviously the French École Nationale, they had a very technocratic process designed specifically to produce a technology (indistinct) after World War II and that was at its peak of success at that time, and while Australia obviously is not lacking expertise, at the same time I don't think we have anything comparable here.

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MR JACOBI: Moving now to - I want to address the response or the likely transition pathways that might emerge in a broadsheet for 450 ppm. I'm interested to understand - first of all, putting to one side policy as a driver, the extent to which you think the economics of new technologies (indistinct) batteries might drive - how far they'll take us on a particular transition pathway.

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40 PROF QUIGGIN: Well, if we look at with no change in current policy we are likely to see, I think, this isn't economically the most efficient route, but because of the penalties imposed on new buyers with rooftop solar and very high costs that come with electricity, I expect we'll see a significant uptake on the solar-plus storage systems and that expectation is precisely why Tesla has chosen to launch the Powerwall in Australia ahead of the US which would be

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the obvious first market. So I think we'll see a significant movement in that direction, assuming that we've stabilised a renewable energy target and that we are past the kind of anti-NIMBYism that, you know, whilst characteristic of the recently departed leadership, I think we'll see a renewal.

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There are a lot of new projects waiting to go ahead. So I think in the short term, we'll see significant growth in that direction. I think there's substantial capacity to expand renewables based on current conditions, the renewable energy target. By the time we reach the limits of renewable energy targets being (indistinct) see further cost reductions which would make renewables - certainly I think competitive with new coal, for example, I don't expect to see any new coal plants built, but obviously there's a problem of how rapidly we can shut down existing coal-fire powered plants and that does depend, I think, on policy.

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MR JACOBI: Particularly the coal (indistinct) constant and those policy (indistinct) I'm just interested to understand your view as to the extent to which expected reductions in costs in solar PV and batteries might drive us in terms of a pathway to emissions reduction on their own.

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PROF QUIGGIN: I think the big difficulty is the existing coal-fired power stations. So there obviously capital cost has been amortised. In the case of brown coal, the fuel has no other use. It's almost free. I think we do need policy there, but I think we're already - the economics is at a point where those technologies will be competitive with new coal and new gas. So I expect to see - I don't expect to see much new investment in coal even at the current policy settings, but I think to make the change fast enough we would need to see changes in policy, broadly speaking, in the direction of what we see that was prevailing a few years ago.

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MR JACOBI: Assuming an end outcome or agreement that 450 ppm is the target at the two degree limit, do you have a view about how quickly existing coal plants need to be retired and about when you might need to start and what the very latest dates might need to be?

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PROF QUIGGIN: Well, economically, the sooner the better. The sooner we act, that is, the optimal time path would be one which started - we had already started, so, yes, I think we missed an opportunity there.

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MR JACOBI: We've touched on this before. Can I get you to unpack that a little bit - - -

PROF QUIGGIN: Sure.

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MR JACOBI: - - - in terms of - you identified it would've been economically

better if we had done it 15 years ago. Could you explain the rationale for that?

5 PROF QUIGGIN: Well, what we don't want to do then is have a rush - is delay things. Delayed things have accumulated a large - have used up most of our carbon budget and to forego relatively low-cost transition options, like gas, to need a large-scale upgrade of the grid. You could try and do this rapidly, you know, in 2030, with a requirement to very rapidly reduce to near zero because we've used up most of our carbon budget we'll certainly end up incurring substantially greater capital cost than if we take the process more gradually with the constraint being the capacity for any renewals, but that's obviously not a constraint that's binding at the moment. We've seen substantial cutbacks in the renewable sector. Simply by bringing back to where it was two or three years ago, we could substantially accelerate the process of transition.

15 MR JACOBI: To come back to time frames for retirements, and I understand your view about the optimality of retirement early, but do you have a view about the latest time frames for retirements in order to be consistent with that 450 ppm outcome?

20 PROF QUIGGIN: Yes, and that does inform my submission. In my view, there are different ways of doing it, but broadly speaking if we haven't substantially retired large sections of the coal fleet by 2030 I think there's no chance of meeting our targeted list. If we're on the current business as usual projects, although they may be a little pessimistic as to the scope for 25 renewables to be substituted, we're way off target with those business as usual projections.

MR JACOBI: You said "large sections of the coal fleet". Are you able to give a broad idea in terms of the amount of generating capacity?

30 PROF QUIGGIN: I haven't got a number off the top of my head. Obviously, we want to start with brown coal because that's the most polluting, as well of course having substantial local costs. In terms of particulate pollution, brown coal of course is a much more carbon intensive fuel than black coal. In terms 35 of order you process, that would be the place we would like to start.

COMMISSIONER: Is it your view that renewables can just take up that in the generating capacity?

40 PROF QUIGGIN: Over a substantial period, yes. I've argued against the notion that there is a substantial so called base load demand which requires 24 hour availability of power. In my view, what we see, in fact, is a large portion of that demand is generated by the fact we have pricing structures designed to take up the excess capacity of coal fired power stations by encouraging people 45 to use, for example, to heat their hot water late at night, solely in order that



they can keep the coal mine and power stations running. In my view, we could simply add renewables for quite some time.

5 As we reach the final stages, we need more, we need to cope more with 1980s  
intermittence and the date of convariability. There are a range of possibilities.  
Obviously, the first thing to do would be change the pricing structures. If we  
are relying substantially on solar power, for example, we want to tell people to  
heat their hot water up in the day time and not at night time when there's excess  
10 power. Looking at pricing policies more generally as part of the story, we can  
look at storage, we can look at gas peaking, and, finally, we can look at  
expanding the grid capacity so that we spread the load more generally.

15 There's a wide range of options to deal with the fact that we're talking about  
systems with very different supply characteristics to the one we have, but I  
think a crucial mistake made by many of the advocates of nuclear is to believe  
the system we had for coal has the ideal generating characteristics and  
therefore the most desirable technologies is one that replicates coal. The most  
desirable ones are dispatchable technologies like hydro and gas that can be  
20 turned on and off cheaply to meet demand, not either coal or nuclear which  
need to run continuously even when there isn't demand, and obviously, solar  
and wind, the problems with those are well known, but I think a conceptual  
mistake made very consistently in the advocacy of nuclear I've seen is to  
imagine that 24 hour availability without easy capacity to ramp down is a  
desirable characteristic rather than a limitation of a power source.

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MR JACOBI: There were many, many things in the answer you've just given,  
and I hope we can pick up as we go along with the next quarter hour or so. The  
first is this issue of pricing structures.

30 PROF QUIGGIN: Yes.

MR JACOBI: I'm just interested to understand the sorts of pricing structures  
that you think we might expect to see develop in Australia over the course of  
the next 15 years with electricity.

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PROF QUIGGIN: We have, of course, the technology now, but we've  
unfortunately not done a great job in terms of social licence of introducing time  
of day measuring, Victoria, in particular, unfortunately made a mess of it, but  
the obvious point is that our peak demand is in the late afternoon, but we don't  
40 have the pricing structure that reflects that. Indeed, solar is actually well  
suited, we have sensible pricing structures, solar panels on western houses  
rather than the north, but the pricing structures we have, have encouraged  
mislocation because essentially that would encourage you to optimise with  
respect to generation rather than to matching demand, so it's an obvious shift  
45 which we could make overnight that would substantially increase the efficiency

of rooftop solar PV as a technology of choice and, of course, (indistinct) that's the kind of thing to have in mind, in particular.

5 MR JACOBI: So the idea is to, in essence, diminish total output from the solar system but essentially deliver out at times of higher value?

PROF QUIGGIN: That's right.

10 MR JACOBI: We've heard some discussion of capacity based pricing from grids. Do you have a view with respect to that?

PROF QUIGGIN: Obviously, if we're going to have reserve capacity that's one way of financing it. As I say, it seems to me that correctly done this would favour gas and hydro rather than, if we did it correctly, all the more  
15 dispatchable capacity. In principle, unlikely a lot of jurisdictions, of course, the market is supposed to reward capacity. If we have a price to put up, \$10,000 a megawatt hour, if you have power available at that time you can get what is in fact a capacity payment, so a lot of discussion of capacity payments is drawn from overseas systems which don't have any in principle capacity, so  
20 it's less clear that we need it here, and I think it's unlikely that it would be a major factor in relevant economics of coal and nuclear because what we're looking for in my view is peaking capacity.

MR JACOBI: We've dealt briefly with base load, and I'm interested in  
25 understanding the extent to which the base load demand that does appear in load curves is a product of the pricing structure.

PROF QUIGGIN: In my view, almost entirely so I think there are special cases which are typically artifacts of special pricing deals, like having new  
30 power plants. We built a bunch of those in various jurisdictions in the 1980s all with special supply deals, but they're an isolated case and we've seeing the departure of most of the Australian (indistinct) plants from competition from China, but that's really largely separate from the typical cases being a dedicated power line and power station (indistinct) in Victoria. Leaving that aside, in my  
35 view, the great bulk of demand we see is an artifact of pricing in the sense that if we had pricing suitable to solar, for example, so power is expensive during the night, I think we would see hardly any demand at that time. We would see very few industrial processes bothering to incur the general extra costs of 24-hour operation if it weren't that they had access to cheap power at that time.

40 MR JACOBI: Do you see there being, aside from aluminium, other plants where they're energy intensive but there is a value with high capacity utilisation other than aluminium?

45 PROF QUIGGIN: I should say I'm not an expert on this, but I think the

crucial edge of aluminium is the nature of the hotline process means that turning it off night is very expensive. As far as I'm aware, we don't have many other activities where that's the case. Typically, it's expensive to run a night shift, you know, typically unless you have the incentives provided by cheap power, I don't believe we would see many 24-hour industrial processes going on. They would have to be not only electricity intensive but also highly capital intensive, because otherwise you just use the electricity when it's available and, in fact, that happens later on at night which is, of course, what happens in the vast majority of the manufacturing sector, and of course retail and domestic demand, of course all those things drop to minimum levels in the morning hours.

MR JACOBI: You touched upon it earlier and you spoke about the installed battery, in-home storage technology - - -

PROF QUIGGIN: Yes.

MR JACOBI: - - - and you spoke about that interrelationship to the pricing structure we have in Australia. I'm just interested if you could explain your view as to how the Australian pricing structures favour the deployment of that sort of technology.

PROF QUIGGIN: Sure. In my view, we've seen further mistakes made in pricing policy in recent years, essentially designed to discriminate against solar rooftops, solar PV, so we're now looking at a situation where - - -

MR JACOBI: Sorry, can I just get you to - - -

PROF QUIGGIN: Sorry.

MR JACOBI: - - - go ahead and explain that in terms of - are you talking about the feed-in tariff prices?

PROF QUIGGIN: Yes, I am. So the feed-in tariff gave overly generous returns to solar feedback into the grid. In my view, the tariffs to replace them have over corrected that, so owners of solar PV are being penalised compared to other suppliers of electricity to the grid essentially because the regulators have taken views favourable to those suppliers. The result is to provide a very strong incentive to home consumption, you can get less than the full price for putting electricity in the grid while you're paying the higher retail price for taking it out, and so you can pay three or four times as a new supplier and new installer of solar PVs (indistinct) being part of the existing (indistinct) tariffs are a huge incentive to consume your own generation, and so that, I think, is higher in Australia than anywhere in the world, which we have some of the highest distribution charges anywhere in the world and some of the less

favourable feed-in tariffs going. So that produces a very strong incentive for storage under carbon emissions.

5 MR JACOBI: We've touched on other pricing structures, capacity-based, time-based for use. How do you see there being an optimisation? You talked about there being this - it's gone from a situation of overpayment, in your view, to one of underpayment. What do you see is the optimal result?

10 PROF QUIGGIN: Well, in my view, if we moved to time-based pricing in general, we would have much more sensible incentives facing households in terms of the way they structured their demand. It's important to remember that although the regulators have come down very hard on solar PV, airconditioning is really the thing that's most distorted by the current pricing structures. We really don't pay any premium for using in airconditioning when it's contributing  
15 most to peak demand. So all of those things would be much more efficiently done if we had time of day pricing.

And I think compared to capacity pricing, we're much closer to achieving it. We only really need a decent political push, some good sense in terms of the  
20 way meter are installed and paid for, and some degree of concern about the inevitable cases of – particularly sympathetic cases who are hurt by changes in pricing structures. But even if we move to offshore pricing structures of time-based pricing, I think we would achieve a lot in that way.

25 MR JACOBI: I'm interested in the optimality of the pricing for the supply of electricity by essentially home owners that have solar PV systems. Do you have a view that they should, in essence, be generators that feed into the market and are priced accordingly as well, or do you have a view that there's some version of that as opposed to the fixed price that they get from retailers?

30 PROF QUIGGIN: So in my view, and I'm not an expert, but my understanding of the way that it's developed is that, in fact, solar PV suppliers, unlike remote generators, are taking load off the distribution grid when they feed back into it; that is, they're supplying power to nearby houses. If we look  
35 at the reasons for the huge increase in the cost of the grid, a large part has been upscaling the local part of the distribution network to cope with more peaking demand arising from airconditioning and greater demand for reliability associated with home computers and things of that kind. So it's my view that, in fact, the correct price for solar, the correct feed-in tariff would be above the  
40 pool price, allowing for a reduction in distribution cost rather than at or below it, which we're seeing in current determinations.

45 MR JACOBI: You mentioned gas, and I think we'll ultimately come back, I think, to where we started to transition pathways, you mentioned gas in your answer in respect of the optimality of the peaking supplies. Prof Garnaut,

when he gave evidence, expressed a view, his view that he had expressed I think back in 2012 at the time of his second report where gas would be very important, had been affected by recent experiences of increased gas prices in Australia, and future, and he expected maintenance of those prices at those levels. Do you see that being a factor in your analysis with respect to gas?

PROF QUIGGIN: Well, it's relevant. I think if I have the answers correct, the opening up of effectively Australia's world market has eliminated an artificial advantage of gas in Australia, but it's still my view that the supply characteristics of gas are ideal, and it's important to note again that existing policy, which is basically now only the renewable energy target, discriminates against gas.

So one of the options the Climate Change Authority is looking at is a low emissions target, which, among other things, or at least in principle, allow for nuclear, which would effectively treat the fossil fuel as not on the basis of whether they're renewable or not, that isn't really a concern, but on the basis of how emissions intensive they are. That would give gas a much lower requirement to offset itself than black or brown coal.

So we are seeing under current structures in which we're relying much more on the renewable energy target than on carbon price, we are, in fact, unfairly handicapping gas as a source. So if that were removed, either moved to a substantial carbon price, one which by redesigning the renewable energy target, gas as a transition fuel, as a peaking fuel, but I think proved again. The authority is looking at a bunch of different scenarios in procedural commission, but obviously I'm not speaking on behalf of the authority, but that's the kind of picture that we seem to be looking at.

MR JACOBI: I can understand how that would work with a market price carbon in terms of the fact that, in the end, gas's position would reflect its actual emissions output. How is it that a - perhaps to call it a low emissions energy target or clean energy target, could accommodate technologies with different greenhouse gas emissions - - -

PROF QUIGGIN: Well, yes, so essentially the current thing is binary, if you're non-renewable and you have to buy a renewable certificate for each megawatt you generate, and perhaps (indistinct) if we said that the state - taking gas as the unit of that black coal power station, had to buy twice as many certificates and brown coal power station had to take three times as many certificates affecting carbon emissions, this would in effect be a the carbon price for electricity.

So, in fact, in my commentary on the renewable energy target, I would make the point that, in the absence of adequate carbon price, even the highest level it

reached under previous government was still well below what's optimal for a renewable energy target that's a kind of carbon price. If for political or other reasons we wanted to use that as our instrument, we could refashion it so that the electricity sector, it effectively replicated the operation of carbon price.

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MR JACOBI: You referred, I think, we discussed the modification of the RET as a possible option. I noticed in a media release released by the Climate Change Authority that it's to report, I think, in May of next year on a range of possible transition pathways. I don't want to forecast what's going to be in the report, but I'm seeking the sorts of broad themes that need to be considered as part of that sort of analysis in your view.

PROF QUIGGIN: Yes, well, again, just speaking for myself, the obvious choices are essentially the kind of technique - a purely price-based policy, a purely renewable energy target policy with something like the existing scheme and without having been effective in the context of the non-covered sectors, more direct action types of policies, using that term literally, things like vehicle fuel emission targets, that's outside our sector, but, well, potentially not, of course, because electric vehicles are a major part of the potential story and could help to offset the - could help to manage things like time variation supply. So that's direct action in the ordinary sense of the term; of course, it's now used to include more to an option-based, subsidy-based scheme, which is another kind of price-based policy. Those are possibilities.

Buyouts for coal fired power stations I think are one of the options, what we'd look at, more intensive promotion of energy efficiency there are a range of possibilities we could look at on the assumption that we are able to reach a high enough a carbon price to deliver the whole goal in the short run, and also because there are many limitations on price mechanisms, which although they don't appear in the simple textbook, once you start having a view of the policy, you see that they don't work nearly as quickly or as simply as you might hope.

MR JACOBI: I was actually interested in coming to this in terms of the - starting at, one, from a market price for carbon in terms of driving or shifting the cause in closures of particular plants and, on the other end, making payments. Is there a range of strategies that are sitting between?

PROF QUIGGIN: Well, there certainly are a range. I mean, depending on how we structure the electricity market, of course, we've seen renewables with zero margin costs driving out other sources in the market. So if we wanted that goal we could certainly tweak the operation of the electricity market. The constant theme, unfortunately, is that not only has it been badly designed itself but even though the National Electricity Market virtually coincides with the summit, the design has paid no attention at all to greenhouse gas issues and built nothing into their design that's in any way helpful to the operation of such

a system. Undoubtedly, we could change the operation of the electricity market in a way that pushed competition in that direction.

5 MR JACOBI: Perhaps we can finish off. Do you have a view about the role that nuclear might play in other countries in terms of stepping outside Australia and the issues that we addressed with the Commissioner at the commencement about the extent to which you think nuclear might form a role and play a role in terms of delivering other countries' commitments?

10 PROF QUIGGIN: In general, my view has always been there should be more strategies. I think looking at the evidence 10 years ago you would have favoured, in the absence of deliberate changes to carbon capture and storage and nuclear power as two of those policy technologies, the evidence in the last  
15 10 years has been very discouraging for carbon capture and storage and quite discouraging for nuclear. So I think if we got some favourable suppliers on the cost side, if the Chinese and UAE plants go ahead and don't run into the kind of difficulties we've seen elsewhere, then jurisdictions that have the capacity to take the kind of top-down decision processes that those countries have. It would play a role.

20 I have to say that the current technological trends haven't been – even in countries like China, they haven't really been such as to favour nuclear. We've seen, compared to, say, 2010 before Fukushima, we've seen a scaling back of Chinese nuclear and a dramatic expansion of renewables. Of course, while  
25 (indistinct) experience in various ways, almost certainly it's going to imply a requirement for more expensive safety mechanisms which are in place that were considered acceptable in 2010. That of course adds to costs. That depends a lot on how you are going to (indistinct) operators.

30 It certainly is a possibility but I think, as I say, you need very specific conditions to have – if we look at nuclear as an economic option, we've only really seen one well established success in the 1970s, one potential success, China now. We may see some others but everywhere else either the economics has been bad or, as we've seen in the Soviet Union, the economics look good  
35 until you took account of the failure to put in the necessary safety procedures.

COMMISSIONER: Professor, thank you very much indeed and thanks for coming in on your holidays. It's much appreciated. Adjourned.

40 **MATTER ADJOURNED AT 2.43 PM UNTIL  
TUESDAY, 29 SEPTEMBER 2015**