

Energy Futures Seminar: Chief Scientist Alan Finkel's Review of the Security of the National Electricity Market

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Australia's energy sector faces major challenges in the shift towards a low emissions future. In the wake of several electricity system disruptions, and particularly the South Australian state-wide blackout in 2016, Australia's Chief Scientist Dr Alan Finkel has chaired the Independent Review into the Future Security of the National Electricity Market. The breadth of submissions to the Finkel Review, and the ongoing public debate, both mark the community's determination to help shape the future of our electricity sector.

This Energy Futures Seminar followed the release of the Final Report of the Finkel Review. Dr Finkel and a panel of experts discussed how Australia can respond to challenges that our electricity system faces. Dr Finkel outlined his blueprint for reform of the National Electricity Market, including recommended changes to policy, governance and market rules. This was followed by a discussion between our panel of experts and questions from the audience.

Moderator: Sabra Lane, Chief Political Correspondent on ABC's 7:30

Speakers: Dr Alan Finkel, Australia's Chief Scientist
Audrey Zibelman, CEO, Australian Energy Market Operator (AEMO)
Tony Wood, Grattan Institute

Good evening ladies and gentlemen, welcome to the University of Melbourne. My name is Iven Mareels, I'm the Dean of the Faculty of Engineering here at the University of Melbourne and it's a real pleasure for me to be able to introduce tonight's lecture on energy futures where we're going to hear about Alan Finkel's Review of the Security of the National Electricity Market (NEM). The interest has been overwhelming and we have a full room, and I'm certainly looking forward to a very engaging evening. Before we commence this evening's proceedings I would like first to acknowledge the traditional owners of the land on which the event is taking place, the Wurundjeri people, and pay our respects to their elders and families past and present. Tonight's seminar is the second in a series called Energy Futures. I would like to thank, in particular, the Melbourne Energy Institute (MEI), who is also represented here by the Dean of the Faculty of Science, Professor Karen Day who is the Custodial Dean for the Energy Institute, and the Grattan Institute, who proudly co-sponsor the event tonight. We're also pleased that the MEI here at the university was commissioned as part of the Finkel Review process to assess the security of the power systems that might arise under the very different scenarios of emissions reductions. This work was led by the Melbourne School of Engineering, Professor of Power Engineering, Professor Pierluigi Mancarella.

I would now like to welcome Sabra Lane, ABC and Radio National AM host, who will be our MC for tonight. Thank you for visiting the university and I hope that you all enjoy tonight's event.

SABRA LANE: Thank you and welcome everyone, there's nothing like a good chilly Melbourne night to reinforce why we're here. Thank you for all coming here tonight to be part of this really important discussion and thank you to Dr Alan Finkel, to Audrey Zibelman and Tony Wood for being part of this tonight and for being part of the panel discussion. Each of our speakers will firstly give an outline of their area of expertise before we have a free-flowing discussion, and then we'll take some questions from the floor. If only Dr Finkel and his panel could've figured out a way to harness the emissions and hot air coming from Canberra over the past ten years we could power this country for another hundred years alone. Over the past ten years we have come to a policy paralysis, basically, on this particular

issue. This issue, climate change and energy, has seen off two Prime Ministers and an opposition leader. The unprecedented power blackout that we saw in South Australia last year prompted COAG (Council of Australian Governments) to commission Dr Finkel to review energy policy, to devise a blueprint for the future. The closure of Victoria's Hazelwood plant made the issue really more pressing for the nation. Most Australians are rightly confused, wondering how on earth has it come to this, a nation that should be an energy powerhouse in the world is now stuck in this policy paralysis bitterly divided on what to do. I know because I prod our political leaders on almost a weekly basis on this issue and recently I've spoken with Malcolm Turnbull, Josh Frydenberg, Matt Canavan, Mark Butler and a host of experts, including Tony Wood, about what to do.

Now Dr Finkel has come up with his blueprint. It was revealed weeks ago before COAG and just yesterday at the National Press Club he had an opportunity to outline that plan. Tonight he's going to give us a shortened view of that, so good evening and welcome to Dr Alan Finkel, Australia's Chief Scientist.

ALAN FINKEL: Sabra, you mentioned about harnessing the hot air and as you were saying that I was thinking we were the wrong group to do that. The CSIRO does a lot of work on enteric fermentation and methane emissions from cows, and maybe that's where they should be looking for their next project. I'm just going to try and give you a short overview of what was in the report, I'm assuming actually that you've all read it, it's only 212 pages, so I'll pick out some of the key highlights of what we call the blueprint for the future. It's worth noting Karen Moses, Chloe Munro, Mary O'Kane and Terry Effeney were the group that helped me, but we were supported by a fantastic taskforce put together by the Department of Energy and Environment.

Let me take you through some of the essentials. We have had what I tend to think of up until recently a hundred years of sameness in the electricity industry. Basically, what you saw was centralised electricity generation and it didn't matter what the primary fuel source was, it could've been coal, hydro, gas or diesel, they were synchronous generators, they were really well-behaved on the electricity market, they understood frequency and voltage strength; they did good things. Electricity always flowed in one direction along through the transmission network, through the distribution network, managed through the retailers on the way to the end user, the consumer. Whether that's an industrial, commercial or residential consumer, that's the process that we've had and it served us very well. The NEM was formed in 1998, it brought governance and economic benefits to what had been isolated state-based approaches, and we've had stability and low prices until the last few years. So it did serve us well but then along came disruption, and we're talking about serious disruption. The thing about disruptive technologies, disruptive expectations is you cannot unwind them. So let me just quickly take you through some of those disruptions.

There's the sameness, the traditional electricity generation we've had, but now it's evolving. It's evolving because we've now added in largescale solar and wind generators and, as most of you in this audience would be aware, the prices of largescale solar and wind have come down dramatically. It doesn't matter what your background is, whether you know about or care about climate change, the fact is that technology is disruptive, it's there, and not only is it a form of generation, but it changes the nature of the way the various generators play with each other and actually makes it more difficult for traditional generators. But it also opens up many opportunities. In addition to that, we've had the introduction of what is approaching two million rooftop solar PV installations, so we've now got distributed micro-generators all over the place and they also change the nature of the daily load curve and the economic opportunities for the players in the system. You can't unwind that and the costs are such that, even without subsidies, everybody expects there will be more and more solar rooftops. Then storage, the innovation in battery technology is staggering and it's driven by all of you and your three billion friends around the world who have smartphones and laptop computers and want those to operate for the

longest possible time between charges. Courtesy of that, manufacturers have been able to repurpose the fantastic revolution in battery technology that has supported mobile computing and mobile phones into grid-scale batteries.

So now we're getting grid-scale batteries around the world linking to the transmission network and providing a number of services, including largescale storage. It's not yet huge, I'm not suggesting that, but there are significant installations around the world, there are significant installations underway in Australia, and the cost is not unreasonable. The price has come down on factories to a half every five years for the last 10 to 15 years, which means every decade they come down to 75% to a quarter of their previous price. How long that can be kept up who knows; innovation is a wonderful thing. You're seeing batteries being installed in end user premises which means that the end user, with solar panels and a battery, is in a much more powerful position to manage their electricity use. Of course, there's the potential for largescale pumped hydro in Australia, we've had the ANU map out hundreds of sites and we've had the federal government commence a process of investigating and making a commitment to largescale pumped hydro in the Snowy Mountains. The nice thing about pumped hydro is that you get zero emission storage, but you also get all the essential security services that conventional generation brings with it.

The other really transformational change is that electricity is starting to become multi-way or bi-directional. Consumers are pumping electricity into the system and that, again, changes the nature of operation and can't be reversed. Another big change is that automation is coming to premises to help consumers manage their consumption. There's been a dream for a long time that if you give appropriate signals to residential consumers about the price of electricity during the course of the day they'll manage their electricity consumption. It doesn't work. Nowhere in the world has that worked. Even if you start off doing a trial with engaged consumers, in just three days they lose interest. People don't want to manage their electricity, but with smart appliances and smart software they only have to once every X years set it up and then it all runs for them and everybody can benefit. I'll come back to that. Then the last thing is the opportunity for peer-to-peer trading. You can't do peer-to-peer trading of your solar power by throwing a cable over the back fence to your neighbour; you have to use the resources of the distribution network, so that puts another pressure on the way the distribution network works and it doesn't work without a lot of intelligent software to make it possible as well.

So you can see that there are many, many technological disruptions, but there are other pressures on the traditional network. One is the international obligations that we have. We made commitments under the COP21 Accord in Paris, the Paris Agreement, to reduce our emissions and electricity has to play a significant role in doing that. I won't go through the story, you all know carbon dioxide is going up like that, this is the ice core record and this is the more recent 50 year atmospheric record, and through the Paris 2015 COP21 Agreement we committed to X% by 2030 etc. So that's a significant non-technological pressure that the traditional system is under. Then there are price increases, the price of electricity, it's hard to actually give it a specific number, but you could say it's doubled in about ten years in real terms for many, many reasons, and I'll go through some of the reasons why later. The other thing, of course, is more and more external threats: cybersecurity, extreme weather events. All of these things have been happening and the system hasn't been adjusting very rapidly and has been struggling to keep up. There have been a number of reviews on various aspects of the NEM done by different groups, but not a large review. The tension, the frustration has been building up in government circles, in the circles of regulators and participants, and that tension was getting near to breaking point by the time there was that extreme weather event in South Australia on September the 28th last year.

The extreme weather event, as I showed in the previous slide, took down pylons, did lots of bad things. You might have noticed there was a huge amount of finger-pointing between federal and state governments accusing renewables and weather and climate change etc. As a result of that, the COAG

Energy Council, with support from the COAG leaders, the Premiers and Prime Minister, decided that there needed to be a largescale review into the performance of the electricity system and they decided to set up what's formally called the Independent Review in the Future Security of the NEM and locally called The Finkel Review, because they asked me to chair it. They gave me wonderful panel members and a taskforce and we worked hard, we did a very deep dive, and we'll talk about that later on. We subtitled it "the blueprint for the future" because in the terms of reference they asked us to develop a blueprint for the legislation and regulations that would ensure the most appropriate and best operation of the network into the future, focusing on security, reliability and affordability, but cognisant of the international emissions obligations. So how did we do it? We decided to be very, very consultative. We had over 120 meetings with stakeholders and 450 people came to public consultations. We got a massive number of submissions, I'm sure at least a dozen or two of the submissions came from people in this room, and the submissions were fantastic. Everybody takes the electricity system seriously. I think on the first day after the announcement of our review every person that's ever worked in the electricity industry contacted me to offer their help. I would also say that if I had to reach out, and I did, during the course of the review to people to request their help it was always willingly given. It was really quite remarkable.

We met with operators and regulators across Europe and the United States, we went and we travelled and not only did we meet with the operators and regulators, but also with the Department of Energy in America and some of the big engineering firms that are working across the spectrum from generation to demand-side management. We commissioned the International Energy Agency that's headquartered in Paris to do a custom report for us looking at world's best practice in this area and, very importantly, we commissioned two major ongoing projects, one through Jacob's Group to do economic policy scenario analysis so that we could look at different ways of integrating emissions reductions policies and energy policies, and I'll tell you a little bit more about why we wanted to do that later on. That was done to a great deal of detail, but that's not enough. You can't just look at the economics of this, you have to make sure that whatever you're recommending provides security and reliability into the future and for that, as you heard earlier, we commissioned the MEI, which is part of the Faculty of Engineering here at the University of Melbourne. It was fantastic working with them, they're serious power systems engineers and they analysed the results of our policy scenarios to give us comfort that we would continue to have a secure and reliable system.

One of the topics that I'm sure 385 of the 390 submissions mentioned was the topic of "business as usual" not being acceptable. Everybody realises that we can't just keep doing what we've done in the past; it's not possible in a world of disruptive technological change and a whole lot of other exogenous pressures on the system. So what mental attitude did we come in? Did we come in with an ideological agenda? No way. I certainly didn't because I'm not either left leaning or right leaning, I don't really have a political inclination. I have a PhD in electrical engineering, but a different kind of electrical engineering. I designed scientific instruments, microvolts, nanoamps, very different to the world of power engineering so I came in very open-minded, as did the panel. The actual approach we took was an engineering approach. You're building a bridge, do you seek perfect? No. Engineers, I'm sorry to say this, do not seek perfection because you can't afford perfection. Do you compromise? Engineers definitely don't compromise because bridges fall down if you compromise on the design. What engineering does is it optimises and I can say with some degree of pride that I feel that we have delivered not a consensus, not a compromise, but an optimised package in the review that we've put forward to the government.

Our recommendations focus on outcomes and this is important. We're not focused on inputs and outputs; we're focused on the big issues here that we care about. Those outcomes are supported by three key pillars. Now, I don't have time to go through every detail of all of these so I'm going to just touch on a few examples from within these outcomes and pillars. The outcomes are security, reliability, lowest cost (call it affordability if you like) and lower emissions. That's what we care about. They're the

outcomes that we have to achieve. The pillars that support them are what we call an orderly transition, which is the way we're integrating emissions reductions and energy policy together; more system planning - in a very complex world in transition you can't just rely on market forces, market forces are important but markets need to be managed to some extent; and stronger governance, we feel that the system as it is at the moment has fallen behind a little bit but can easily be not just restored, but put onto a front foot approach. Those are just a few examples. On reliability, one of the things that we've recommended is a generator reliability obligation. Basically what we're saying is the new windfarms, the new solar farms, actually all new generators need to provide some of the essential requirements of a well-functioning system. One of them is that they can provide electricity when it's needed, not just when they feel like it.

So what that means is that a windfarm in future or a solar farm would have to have some kind of storage facility. The picture there shows an actual windfarm with battery storage, but we haven't recommended battery storage, we just said it has to be able to dispatch when needed. Basically, AEMO, and you'll hear from Audrey later on, typically knows the day before that they're going to get into a difficult situation, so it could put out a notice to the generator community to say, "Be aware that we're going to have major load and need of your capability tomorrow". So 362 days of the year they can use those batteries however they're like, but if they're put on notice they have to keep stored energy in reserve so that at five o'clock on an extremely hot summer day, when there happens to be almost no wind and the sun has gone down and there's almost no solar but everybody is still using their air conditioners flat out, you've got something to deliver. The quantity of storage will depend on the state that it's in - New South Wales has different requirements to South Australia - and it will be worked out not by us, but by AEMO and AMC to balance future needs and economic burden or financial burden on the new generators. Another outcome is to achieve lowest long term cost. We can't promise low cost. We'll never go back, I don't think, to the very low prices of the past, but we can do better than would happen if we're not thoughtful. One of the ways to do that is to reward consumers for the role that they play in the system.

What I've got here is a picture from South Australia on the very hot day on the 8th of February this year. Ignore the other lines at the moment, the red line is the actual demand in the system and you can see it's very peaky; it goes to a very high peak. If you can encourage consumers using automation software to shake their demand, their load, certainly taking a bit more during the middle of the day and a bit more at the end but not that much in the peak, that's fantastic because you reduce the amount of current that has to be supplied through the system. They deserve to be rewarded. Now, not everybody can get that because not everybody has solar and batteries and not everybody is going to have the intelligent appliances that enables them to manage their load, but it's important to make sure that everybody else benefits and they will benefit, because if you make this into a substantial contribution the need to build new transmission and distribution lines in future is avoided and the costs for distribution and transmission represents about 50% of the current bill, so it's important to avoid them in future. Also, if you've locked off the top you just don't need as much generation in the system and that's another advantage. Another costing, there are many pressures on cost, gas and everything else, and they're huge, but the long term pressure is just policy uncertainty. Investors don't know what's happening in this country in respect of policies around emissions reduction so we're seeing that that's a big problem and we need to do something about that. Investors understand that they can't have certainty, but what they want is a predictable environment. They will take a chance if there's not going to be constant policy flip-flops. It's like if you're setting off to discover America, you want to have some reason to believe there is land over the horizon before you set off.

We need to lower emissions, so we have modelled a particular emissions trajectory, but we haven't told the government "this is what you must use". In the absence of any other advice from government, we just took the Paris requirements and applied it to the electricity sector, but ultimately the government will decide what they want to do. This blue line is the historical record until now, this is what is expected

over the next few years until 2020, then we have modelled an emissions reduction trajectory to 28% down by 2030 and then towards zero by 2070. 28% down is one of our commitments to Paris, reaching zero in the second half of the century is another commitment. Now let me get off the outcomes and talk about the underpinning pillars. An orderly transition, that's what we need. We don't want a race to a target at 2030 that you say, "What's this?" There needs to be a national agreement by all the state and territory governments and the Australian government to a trajectory. There needs to be an agreement on a mechanism to achieve it, and we've gone for a Clean Energy Target (CET) and there's an Emissions Intensity Scheme (EIS), we can talk about that later. The third thing is a three year notice of closure, so we've said large generators like Hazelwood, which only had five months' notice of its closure, need to think about their business and give three years' notice. Two big benefits, one is communities. State governments, local governments, federal governments can assist if they know there's a closure and also investors will know that there's an opportunity opening up in the market if they get a three year notice.

The next one is stronger governance. I've taken a lot out of it; this is the basic structure of governance at the moment. We have the COAG Energy Council and the three market bodies, AEMO (the operator), AMC (the rule-maker) and AER (the regulator). We've recommended a new Energy Security Board which will be responsible for delivering on the blueprint and providing an annual health check back up to COAG and it will live in-between, if you like, the three market bodies and COAG. It doesn't in any way inhibit their direct connection to COAG, but it provides this integrating opportunity for all of them. I mentioned in the beginning inputs, outputs and outcomes. Most people tend to look at the NEM and they think about have we got the right generation mix, too much coal/not enough coal, do we have the right governance, are there enough retailers in the market to make it an efficient competitive retail market? In a sense you could say who cares? What's really important is whether we achieving the increased security, the reliability, the emissions and the lower costs that we need. You'll see in our review we're very, very focused on that. Modelling results, in terms of the contribution of renewables under the Clean Energy Target the 28% emissions reduction, which is the actually outcome, one of the outputs is 42% renewable energy. On prices what we're seeing is the top line there is "business as usual", the gold line is the EIS and the blue line is the CET. What you're seeing is both of those mechanisms do deliver lower prices in the long run. I can't tell you what the price will be, modelling doesn't tell you actually what the price will be in 2030 or 2040, but I can tell you the relativities between the different policy scenarios.

Lastly, just to finish, let me tell you a few things about where we're at. I presented on behalf of the panel the report to COAG just under two weeks ago, on the 9th of June in Hobart. It was well-received by the Premiers and the Prime Minister, which was very gratifying. Then on Tuesday of this week the Prime Minister and Minister Frydenberg, after truly having worked hard in those intervening 11 days working with all of their colleagues in the party room, back bench and cross bench, but mainly the party room, announced that they have accepted 49 of the 50 recommendations in our review. So I've got the glass and the glass is almost full! The only thing they haven't agreed to is the Emissions Reduction Trajectory and CET, which is part of one recommendation. That's the orderly transition. It's a big one, I agree. The other 49 are important and if that's all we ever got that would be a help, but really we need to do something about these policies. But they haven't rejected it. So they accepted 49 and they are actively considering. They are not lining it up for rejection, they're lining it up, I think, for acceptance, but it's difficult. There's a lot of hot air, as Sabra was saying, going on about this, but given the amount of time it's quite an extraordinary position to be in and it's very gratifying to see the progress. Now, the Commonwealth can't make the final decision. What they've really said is that they are endorsing 49 out of 50 and asking the Minister for Energy to take that Commonwealth endorsement to the COAG Energy Council for discussion in July, which is about two weeks from now.

That's it. Thank you. The little quote up there is from something I referred to in the National Press Club on Wednesday, "everything must change so that everything can stay the same". You can't just hope for things to work out, you've got to be pretty active. Thank you.

SABRA LANE: Our next speaker is Audrey Zibelman. Audrey is the Chief Executive of AEMO and she started as Chief Executive in March this year, so she well and truly hit the ground running. Audrey has extensive experience in the public, private and not-for-profit energy sectors. Before moving to Melbourne, Audrey was the chairwoman of the New York State Public Service Commission responsible for overseeing the regulation and safety of New York's electricity, gas, telephone, cable, water and steam utilities; no small feat. So please welcome Audrey Zibelman.

AUDREY ZIBELMAN: I don't have slides, but I love that one that Alan did. I arrived from New York and the event in New York actually which started us looking at these very same issues was Hurricane Sandy. If you can imagine what it's like, and you might not be able to, living on the 42nd storey of an apartment building and being 80 years old and having to walk downstairs in order to get water and electricity and your kids can't get a hold of you. You can imagine why the Governor of New York said, "We're not gonna do this anymore". So we began a process of saying we also, whether you believe in climate change or not, were facing major climatic events which were affecting our gas sector and our electric sector and in a mega-city like New York or a state like New York where you're highly dependent on energy, we had to re-look at it. We began to look at it in very much the same way that Dr Finkel and his panel has identified as to what are the key issues going forward?

So the first step is this, in the 20th century we designed a system around large central power plants and economies of scale and monopoly systems with the idea that customers' use of energy was not going to be price-responsive and was largely everlasting. Now in the 21st century we're starting to think about the system should be very, very different and if you want to redefine the system you have to do really what I think is just start from the other direction and you design it from the consumer out and you start to think about what consumers want, as opposed to what to generators need. What do consumers want? They want low cost energy, they want it to be affordable because it's an input to their economy; it's not an output. They want it to be reliable; we need to be able to turn the lights on. Increasingly, as we see in Australia and across the world, consumers are revealing their preference around the environment; they want to have a great deal more choice about the selection of energy that they're going to be using. So we have to think about that in the context of how energy is changing and for New York and I think for Australia, how do you retain a reliable system in light of these changes? One of the things that people say is that we have a problem with intermittency, so one of the contexts that we could think about in energy is if you redesign it from the consumer out you could start thinking about the use of distributed resources as not a problem that we have to solve but a solution, and that demand and the ability to manage demand becomes a solution for a good portion of the network.

So one of the things that I think is very important when we think about the Finkel Review and what AEMO is thinking about in a very different way is we start to evolve the markets from a totally different perspective. One perspective is the fact that one of the things we want to do is drive efficiency and modernise the networks, so you could think about that issue and it turns to the point of this which is the system itself, the electric system that was designed in the 20th century, was designed around the fact that you needed a great deal of redundancy and that the system itself had to be able to meet demand during all hours, even during peak hours. Since electricity has to be manufactured instantaneously, it's the only produce that's truly real-time, you consume it at the same time you produce it and so we built a lot of inefficiencies into the network. There are parts of Australia today where we say that basically we've got about a 50% capacity factor meaning that 50% of the system is sort of sitting there idle just a few hours a year, and that's what Alan was saying drives prices up. So what if we then combined some of these issues that we're worried about and think about how do we produce this differently?

One issue is that we are concerned about cost. The other piece that's changing in the electricity networks for the 21st century that was different in the 20th century, in the 20th century, especially after World War II, across the world demand kept going up and it was going to be infinite growth. What's happened in the last 15 years that we see throughout the world and, more increasingly, even in areas like New York City where if you go through everyone's building bigger buildings, demand is going down because the buildings we're building are more efficient than the buildings we built and that means that we're not seeing this growth. So all these things are combining to look at certain solutions that then start solving the problems that we're talking about here. One is the fact that we want electricity to be affordable, secondly, we want to provide more choice and, thirdly, we're seeing the cost of solar and wind come down, and so we need to have the system be smarter and faster. All of this is around I think some of the things that the report identifies as solutions that need to be thought of. One is using demand better, so think about it this way: rather than having to build a generator and transmission and distribution plant just for those few hours a year, if we had distributed energy resources and we send the right price signals it's doing a number of different things, but one is it's driving the efficiency of the networks. One of the things that's true in most 21st century companies, it's not about capital spend but capital productivity and what we want to do is use the capital that we're spending in energy in the most productive way possible, which means creating a two-way system.

The other point is once you have a two-way system you have demand that can respond to price signals, but you can also have demand respond to the availability of other resources on the system. So let me give you another example to the one that we were just looking at. The wind blows at night and the wind blows fast at night; it doesn't blow very well on a hot afternoon. If you know it's hot and stuffy, the wind's not blowing. So what if we can use demand better and move it to the evening hours? So we're not cutting and curtailing load, which people think about we're telling people to turn the lights out, rather we're sending price signals and saying if we could use the demand at night, so we can charge our electric vehicles at night, we can charge our batteries at night, we're then using wind energy. To start using those resources and shifting the demand to the night-time so suddenly demand itself becomes then a valuable resource that you can move on the grid and makes the whole thing more productive. So from that perspective, the things that AEMO is thinking about as we move into this new environment are many of the things that have been identified in the blueprint that are necessary to do. One is we need to get better price signals out to the value of being able to shift and respond to load. Secondly, we have to realise that the resources we're talking about are moving much more quickly than traditional resources, so with the opportunity to make the grid actually much more responsive to changes. So we have to have faster price signals.

Third is we do need to think about forward markets. If I were to go to a large industrial customer and say, "Tomorrow's going to be hot, we're going to really need you to shift your shifts so that you're maybe moving people to shifts at night rather than during the day". I can't tell them that real-time. So we could start thinking about day ahead markets and giving people the opportunity to plan and distribution utilities the opportunity to really think about how they can shift load and drive productivity. So it's thinking about we can't continue to operate the markets as we've done in the last 20 years, which have operated very well, when we have a very different taxonomy of the system, we have different resources. So stepping back and saying we've got to think about the markets in a way that is willing to look at it from a customer perspective and not based on what we've done historically and incrementing, but actually being willing to take a broader comprehensive review is very critical. So I think the points identified in the blueprint are things we need to look at and things that AEMO certainly going to be working with, with the market bodies as well as our market participants.

The second issue I think that's important is both planning and the transition. I do like this statement that "hope is not a plan". I think it's true. We can't hope anymore for good outcomes, so thinking through what these systems are going to need, setting the price signals, providing some level of predictability is

important and I think we can't forget the fact that we're asking people to make multimillion dollar investments. In order to do that they have to have some level of certainty of how they're going to recover that, where the needs are, but it's also about data and information that can get out there when we have the ability to really think holistically. The other piece that I would suggest around planning and us thinking about the network and, again, thinking about what the customer thinks about, which is the total bill, is how the system needs to and wants to change. One of the things that we found with national markets is that you have geographic diversity. The wind's not blowing in Victoria, but it may be blowing in Tasmania and rather than just not having that energy available or building another generation plant in Victoria, maybe we need to look at the networks between Tasmania and Victoria. If we build a solar plant in Western Victoria we may be able to build a network that gets better advantage of that plant if we think about where it could be located so it could serve multiple regions. So thinking about the system holistically, not just regionally, is also going to be very critical and that can only happen if you have some form of a national plan and you have the direction from where you're going.

So I would agree with Alan, I don't think this is an Australian issue. One of the things I was thinking about today was it's Australian Energy Week is it's also New York Energy Week and I made a joke, but nobody got it, that energy has become so important we need a week now not a day. The point is that if I were in New York I'd be making the same comments. The issue around this industry is not about technology, it's about energy, market design and regulation. Technology is moving very quickly. What we need to do is make sure the regulatory format and the market format is accommodating these changes so that we can drive efficiency. Regardless of where we are, that is the challenge. The last thing I would say is this: the issue we had in New York is we tried to change how we run the markets and how we did regulation in order to attract investment in wind and solar, so we were trying to get ahead of the game and make sure that what happened, happened efficiently. In Australia we're seeing massive increases in the amount of request on solar and wind, so the investments are coming in. Now it's really incumbent upon us to think about how we design the markets and how we move regulation so that these investments can be done in such a way to provide maximum optimum value to consumers. I think that if we get this right and we think about these vertical markets where we're talking about using things from the meter all the way up to the supply and optimising it not only will we help consumers here, and I'm optimistic that we can get back to those same types of price regimes if we drive efficiency, but I also think we'll be actually creating an energy economy that can lead the rest of the world in how to get this done right.

So we're looking forward to it and thank you for the opportunity.

SABRA LANE: Thank you Audrey and just spring-boarding off that point about Energy Week, I think one of the points that Dr Finkel made yesterday at the Press Club was a big measure of success for your report is that we're not talking about power in three years' time. I hope that happens. Our next and final speaker, before we start our panel discussion, is Tony Wood. Tony is considered the go-to guru in our office for analysis and advice on Australia's energy systems. He's often a sensible voice of reason and is not afraid to call out crazy ideas when he sees them. He's also full of praise when he sees good ideas too. He's the Energy Program Director at the Grattan Institute and before that he worked at Origin Energy for 11 years, so he knows this policy area very well, and he also worked on the first Garnaut Report. Please welcome Tony Wood.

TONY WOOD: Thank you Sabra and good evening. The slide that Alan showed with the ship worried me a little because it was a square-masted sailing ship and it showed the sea being perfectly smooth. My suspicion is that the ship doesn't actually look like that and the sea is not smooth at all. You've heard from the engineer and the operator, you're going to hear a little bit from the policy and the political side of this in the next five or ten minutes. Whether Alan had designed the fit for purpose sailing ship we need for the next 20 years, since we seem to have been somewhat adrift in rough seas in the last four

or five years, remains to be seen. To give an example of how this plays out, I met Audrey in Adelaide three days after she'd arrived in this country and the chair of AEMO had presented the final report on the blackout in South Australia and did an analysis of the causes and consequences of that blackout. In the media the next day half the national press said, "See, renewables caused the problem" and the other half said, "See, renewables didn't cause the problem". There's a perfect example of some of the challenges that navigating this ship through the political waters is going to be challenging.

I just wanted to touch a little bit on what I think are some of the interesting aspects of the Finkel Review in terms of the policy and the political framework that we have ahead of us. The first thing I'd say is that the climate change side of this is both the most important but, at the same time, almost the least important of what Alan has been talking about. I say the least important because we have been trying desperately in this country to try everything else except first best policy and eventually we'll work out that didn't work and we'll go back to the first best policy. In the meantime, we have a journey to go through and we'll try a few more yet before we get there. On the other side of it, in many ways the 49 recommendations that Alan talked about will almost get us where we've been before if we don't start to move forward on credible climate policy. There's the challenge. In terms of some of the specific things, there is I think an interesting shift in the balance between the use of markets and the use of planning. Both Alan and Audrey have referred to the need for planning. The question will be, and we've seen some of the debate already, do we want to have a centrally planned, regulated, government-owned, renationalised energy system or do we want to move away a little from dependence on markets towards something that actually has an element of planning? Where should that sit, what should be the role of the planner, and how much responsibility and authority do we want them to have? They will be questions that will play out in the next little while.

We'll find out whether this report actually addressed some of the fundamental questions that Alan was asked about security and reliability. He's put forward some proposals and I know from my own conversations with Alan that some of the proposals aren't necessarily completely all that was suggested he should do. Other parts of the world have tried different approaches, but nobody, I would suggest, in the world has got this right, nobody, so this is a journey we are all undertaking. I think the proposal for the Energy Security Board will be one of the more challenging ones when it comes to the states getting on board through the COAG Energy Council that Alan referred to. It was, I suspect, relatively easy to get through the Coalition party room the 49 recommendations. When you think about what Alan has said about the way in which state governments are dealing with these issues and the way they should actually sign up to a new Australian Energy Market Agreement and agree to play together and not simply say they're going to play together and go off and behave parochially, then we'll what happens out of that. My suspicion is, as we saw from at least one state government before the Finkel Review was announced who said they would have a taskforce to implement the recommendations of the Finkel Review that they agreed with. You just think about what that is code for and not very well-disguised code, I would say.

In terms of gas, one of the inherent challenges at the moment is that the gas market is particularly nasty and one of the reasons I think the Prime Minister maybe announced, as he did earlier this week, is because not only are gas prices affecting people who use gas for heating and for cooking and so forth, industrial processing, but gas is now affecting electricity prices in a very dramatic way. You could argue that it's not the fault of gas, the reason it's allowed to do that is because of other things that have flowed from that, but it's certainly the case that gas has become very challenging and, again, Dr Finkel has recommended a nationally consistent approach to the development of gas resources. That is not something that the states currently agree with, although they probably would say, "We should all do it the same way; we should all do it *our way*". That's, again, a challenge for co-operative federalism. When you look at the good things about the climate part of it, because Alan didn't go into detail here, I think

we have seen before us in what Alan proposed a serious challenge to adopt a climate policy that has some real chance of getting us to where we need to be.

He's also recommended, and the federal government has supported this recommendation, that by 2020 we'll have a whole of economy emissions reduction strategy to 2050. Not many people have thought about that very much. And that, if they stick to it is a very significant change from where we've been. This is not what I would call the first best policy because we've tried all of those and they didn't get very far, so we have what I think will be a very effective and relatively efficient policy. Alan put up the slides that talked about price and cost, and they're not the same but the difference is within the order of magnitude of the accuracy of the assumptions and models so it doesn't matter much. That's why I said before there are at least half a dozen climate change policies that will get us there, just pick one and now we can do the other stuff. One of my daughters is a singer and one of her favourite musicals is Les Miserable. In that musical there's a thing about dreaming a dream and at the moment I think hope is high. The question is as we're looking into what's happened in the last week or so, the tigers have come out and we'll see, Alan, whether they tear your hopes apart and whether your dream turns to shame. We will see.

Earlier this week I wrote a book for the weekend Financial Review and I reminded people about Galbraith who said that economic modelling was invented only to make astrology look respectable. At the same time, we've had a debate in some elements of the political work which says we do want to go back to the 20th century, that's when things were much more certain, that's when prices were low, that's when knew exactly what we were doing. If the lights went out we didn't care very much, we could use candles. Unfortunately, my children's and grandchildren's laptops and iPads don't work very well with candles, so we cannot go backwards. What I suggest to you as we look at this and we deal with higher electricity prices, is that they will not go back where they were. They will start to ameliorate and as we see the technology changes unfold they will be as low as they possibly can be. One thing we can be certain of in this world of uncertainty is that neither astrology nor nostalgia is a good base for policy making. Thank you.

SABRA LANE: Dr Finkel, I'm going to start with you. Your report was declared in one of the papers yesterday as on life support. As you point out, the government has accepted 49 of the 50 recommendations and I think you said yesterday and again today that's a pretty good result. But still, can the blueprint operate without that 50th recommendation?

ALAN FINKEL: The question was can the individual 49 recommendations be useful in the absence of the big one that has not yet been endorsed by the Commonwealth, which is the orderly transition, and my answer was that absolutely we would prefer to see the full package accepted. That is, in our opinion, the best way forward, it goes beyond nostalgia and beyond astrology. There's a bit of hope involved, but it's also got a lot of logic and optimisation in that whole package. If the orderly transition is not accepted we'll still have a much better system I think going forward from those 49 recommendations being accepted, assuming they get through COAG, but we'll be left in a world of pain in terms of investor uncertainty and that can't be trivialised. I don't accept the characterisation that you referred to from the press that it's on life support. It's really a positive situation. Eleven days after we presented to COAG, the Commonwealth Government, in a very difficult political circumstance, has been able to say that it will endorse 49 of the 50 recommendations and the last one, which is the CET and the emissions reduction trajectory, is actively being considered by them, so I just can't accept the characterisation.

SABRA LANE: It wasn't my characterisation.

ALAN FINKEL: I know.

SABRA LANE: But it was a headline in one of the papers yesterday. I think this is a good question for you, Tony. You've seen the politics this week in Canberra, where some politicians, notably within the Coalition, want coal to definitely have a future and coal does have a future in the CET, it has a better future than the business as now scenario. Does it make sense for the federal government to be getting in with this talk now of possibly funding coal-fired plants, the so-called high efficiency/low emissions plants, through this competitive tender reverse option, whatever you want to call it, given that no private companies or listed companies have expressed any desire to build that kind of thing in Australia?

TONY WOOD: I guess the question that arises for me is, firstly, given the appropriate financial incentives, would anyone build a coal-fired power station in Australia? The answer is yes. If you were given a contractual arrangement similar to what we currently use for largescale renewable energy projects someone would fund it. I would not suggest that would be appropriate for the government. I am far more concerned about renationalisation of this whole system; I think that ends us up in a very nasty place. What Alan has designed is a blueprint and there are various design elements that can be adjusted. So you can, for example, set the threshold below which technologies can generate credits to whatever level you like. If you set it very low, call it zero, you create another version of today's Renewable Energy Target (RET). If you set it quite high it looks much more like an EIS, which the government rejected. So you can create what I would argue was the right economic circumstances to achieve your environmental objectives and, at the same time, if it turns out that those people who are keen on low emission coal technologies can demonstrate that in such a world that's economically efficient I've got no problem with it. I suspect that will be a big challenge.

SABRA LANE: Audrey, you've got a huge task ahead. The Prime Minister said at a press conference on Tuesday that it's now AEMO's role to make sure, and I think I'm quoting word for word here, "there's not a gap in baseload power next summer". No pressure! How are you going to go about achieving that? It seems to me in the short term a massive task.

AUDREY ZIBELMAN: We have no choice. We have to be looking out and seeing what we're going to need for energy over the next five years across the NEM and if, in fact, there is insufficient capability to meet our system we have to have a way to procure it and get these new resources in. We talk about existential threats and I believe very strongly that the greatest threat we have to markets and innovation is if we can't deliver power securely.

I've said this before, while I believe that competition drives innovation and innovation drives better results, the fact of the matter is electricity is an essential service and one thing that good government has to do is it has to deliver the essential services well. So it doesn't surprise me at all when a government is insecure about their ability to provide essential services that they're going to look for ways to intervene, because that's what government should do. So our job really is to work with the markets and ask what can we do in the near term to make certain that I can answer the question can we keep the lights on all the time under reasonable circumstances? I think everyone understands if it's a major storm or if something happens we may need to load shed, but in general I think the expectation in our society and all societies in the developed world is that the lights work, the heat stays on, the schools are good, the streets are safe and the water out of your tap is clean. When those things stop happening then that's when re-election occurs, whether it's in the US or Australia or France or England, and that's really what this is all about.

SABRA LANE: Reliability, but it's also about price. We saw the extraordinary announcement that the government will intervene in the gas market. It foreshadowed that, but it actually said this week it was going to do that and hopefully that prices will come down. We never see the cheap prices that you mentioned, Dr Finkel, but they're hoping to put downward pressure on prices.

AUDREY ZIBELMAN: One way to manage prices, again, is if we look towards productivity, if we optimise these resources end to end, if we do that and we drive the inefficiencies out of the system and make best use of renewables, which frankly can be used in an efficient way, we can drive down price. I look at it this way: if we deliver value to consumers and consumers are happy, then governments are happy and when governments are happy they don't intervene. So our job in the industry is to make sure that the needs of consumers are being met.

ALAN FINKEL: Can I just add to that? We're in a period of transition. If you think of what we've had as NEM 1.0 and where we're going is NEM 2.0, we're in a transitional phase and transition is a difficult time. Government needs to respond to the price pressures and the frustrations of consumers. My hope is that the interventions that they've been announcing and doing will be transitional and they won't be part of the long term. As Tony was saying, I don't think any of us are looking for renationalisation of the system, that won't be cost effective in the long term, it won't be efficient in the long term, but one has to have a little bit of sympathy for the situation at the moment. Governments need to react in the way that Audrey was saying, but if you see it as a transition between NEM 1.0 and NEM 2.0 you can be a little bit comforted that it's not there for the long term.

AUDREY ZIBELMAN: We'll do a dialogue here. One of the things identified in the blueprint is the need to have basically a market for resource security so that we can do this as part of the market. I actually see the announcement about asking us to go out and make sure that the system is secure in the short term as very consistent with that view, and certainly the mechanism that we would look to put in is a mechanism that would actually foreshadow the more permanent mechanisms. I know there are 49 recommendations and I think the blueprint does an excellent job of capturing the needs of the market, but I think we have to think about it this way: our markets were designed in the 1990s when large combustion generation was the dominant force, with hydro, and what we're looking at is rationalising actually some level of overinvestment in supply. Now we have a whole different resource mix and really while the blueprint identifies some very good things that we need in the market, none of it is different than actually what exists today in the European and US markets.

So while I think it's very good, there's nothing in it that's radical so I would be shocked actually if the governments don't look at this, and certainly I know that in discussions with the sister agencies, AER and AMC, we're all looking at it and saying there's nothing out of balance here, why wouldn't we do it? Why wouldn't you want to make the system more secure? Why wouldn't you want an understanding of how it's going to work? Why wouldn't you want to integrate in the cheapest resources? So to me it's just very logical.

SABRA LANE: Audrey, I'm interested, in your short time here you've had a small sample of just how fractious the politics has been here.

AUDREY ZIBELMAN: I come from Trump world!

SABRA LANE: I was going to say, as an outsider, is climate policy as divisive in the US as it has been here?

AUDREY ZIBELMAN: The fact that we're shooting Congressmen in baseball games? It's pretty divisive in the States right now. In the US we're debating the issue of climate change and actually it's not terribly different. I came from New York. New York, California and Massachusetts, they all signed onto the Paris Agreement. The Governors have said, "We don't care what Donald Trump's doing, we're moving forward" and they represent 60% of the US economy. So as far as I'm looking at it, it's the same nature of the same debate in that context. I think the issue for those of us who really see the opportunities here is that the cost of wind and solar are coming down. When I hear Andrew Vesey from AGL I don't think

he's saying he's not going to invest in coal because of environmental reasons. He's saying it's because it's uneconomic and I've heard that from the CEOs of other organisations. So the question for us is not whether or not we want to embrace one technology or the other. The issue is technology has changed, costs are coming down, storage is becoming more and more at grid parity; how do we design the markets and regulation to take advantage of that so that we're moving to the future? So while I think it would certainly be helpful if we could have agreement on the emissions strategy going forward, I think economics are driving a lot of these issues anyway.

SABRA LANE: Just on that cost point, I don't know, you might have been too busy today to notice that Grant King, the Head of the Business Council of Australia, wrote an opinion piece which was published in Fairfax, The Finn Review, today. He said if the government were to finance or underwrite a new coal-fired power plant it would further frighten private investors and force taxpayers to potentially bankroll a second, third or even a fourth power station. What do you make of that?

TONY WOOD: I have to confess, as you pointed out, that I did work with Grant King for many years at Origin Energy and therefore I understand a little bit of what he's saying I think from that experience. People have this view that markets are some sort of sacred animal that behaves in certain ways and can be left alone to do its own thing and that they're very robust, but markets are very sensitive beasts and you don't want to scare them too much. If you muck around with them too much they fall over, they break and they get strained, but they also behave usually predictably, they do exactly what you ask them to do. The trick here is that we've got a situation where there are elements of the market that just don't do what you want. I think it was Audrey I heard say not very long ago that the market isn't the objective; the market needs to deliver what consumers want in the long term. The market may be one way of getting there more efficiently and effectively than government ownership and I suggest before we give up on the market we should think very carefully about whether we want to go back to where we were in the 1990s when, for good reasons, we thought it was a better alternative.

So I think that's what Grant was highlighting. If you do this in a predictable way so that the market operators and investors know the sorts of things that AEMO is looking at and the way Alan has designed this then you know exactly how it's going to go. It's like the Reserve Bank of the energy system. Everyone knows the Reserve Bank can do all sorts of stuff, but they more or less know how it works. That's what I think he was talking about here, that what you need is that AEMO responds in a way that's predictable, but is flexible in the future. So flexibly predictability is what we're looking for. That's what I think Alan is recommending for AEMO and if they get that right then I think you can get a situation where you get the right balance between planning and government absolutely appropriate concern but, at the same time, you get the degree of certainty that you need for investment.

SABRA LANE: Dr Finkel, we had a question come in from the President of Engineers Australia, Chris Stoltz, and being an engineer I thought you might take this question. It says until we have a clear energy policy to guide investment, is it too late to reinstate some of the gas and coal-fired generation capacity?

ALAN FINKEL: Well, Audrey and AEMO have been working with the existing gas generators that, in some cases, have been taken out of the system and so-called "mothballed" to get them to reinstate what they've got so that everything is ready for the coming summer. We absolutely endorse that. I'm not sure that there are any coal generators that you can reinstate. The owners of Hazelwood made sure that they ripped the equipment to pieces really quickly on the final day that they operated, so I'm not sure that is possible. Just going back to the conversation about coal, I've decided there are two types of people in the world, those who love coal and those who hate coal and I'm the only one sitting on the fence, because our focus, as I said, is on outcomes and as long as you're getting the cheapest approach to reliable, secure energy delivery and you're meeting the emissions reduction target you shouldn't

worry. Now, I don't know what the consequences would be if a new coal generator plant, a large one, say, to replace Hazelwood, a 1.5GW or 2GW plant, got built. Some of the people I've been speaking to today suggest that actually it might be a surprise; it might displace existing coal rather than prevent the entry of new renewables. It's been said many times that those new renewables are a really economic way of bringing new generation to the market and they could be firmed up with batteries and other means so that they could provide the constant supply that we need. So until people do some modelling and deeply think about it, we don't know what the unexpected side effects would be of a new coal generator.

The last thing I'd point out is the Prime Minister, as I saw on TV in the press conference, was talking about a reverse option to bring in new capacity. He was asked by one of the reporters does it have to be coal and he said, "No, we will put out a tender for reverse option for somebody to bring in baseload capacity at large scale". It could be gas. A lot of people are saying to me it could be a combination of solar, wind and backup. The market is the right place to work that out.

SABRA LANE: This is an interesting point, Tony, to bring you in on. That press conference happened a day after the Minerals Council gave government MPs a briefing. It's pretty interesting that they were allowed to give them a briefing. What did you think about that?

TONY WOOD: Some of you may have looked at The Guardian today where I've been quoted as saying that the Minerals Council may very well have intended to blow up the entire Finkel Review in its proposal because as a strategy blaming with faint praise is a really clever way to do it, and the Minerals Council has done this before. It could easily be, equally, that the Minerals Council said, "Look, we're going to try and make a constructive input to the Finkel Review and this is our proposal, this is an alternative way of addressing what we think is a major emerging problem in relation to a shortage of baseload generation". We'll see what people think about what the final response to that might be, but I think that the joining of the two was, at the very least, an unfortunate piece of timing.

AUDREY ZIBELMAN: The instruction and the concern I know that we're going to be addressing is this: the expectation is that it'll take some time for us to put the reforms into place that are identified in the Finkel Review. In the interim we need to make sure that the lights stay on, so if that requires us to go out and get additional resources the Commonwealth was, I think, being very pragmatic and prudent in saying we need to have AEMO in a position that it can identify where there might be scarcity and have a mechanisms to procure and make sure that the system becomes secure. So it is a transition element, it is technology neutral and size neutral. We weren't told you have to go out and do 2,000MW, we weren't told it has to be in one place. We were told go out, tell us what the system needs and then design an option so that the best resources, and they can compete head to head, wins. To me, that's a very rational and very market-friendly approach to moving forward.

SABRA LANE: Okay, time for some questions from the audience.

AUDIENCE: I've got a question about the generator reliability obligations for Dr Finkel. I didn't understand, is it proposed that the reliability obligation extends to non-renewable generators as well joining the NEM? And what was the decision in not using the market to directly find the lowest cost solutions, but instead to staple a new requirement onto new generators?

ALAN FINKEL: The recommendation, as with most of our recommendations, leaves the details to be worked out by AEMC, the rule-maker, consulting with AEMO, AER and the participants but yes, it was suggested that all new generation should meet that. If the new generation is gas it intrinsically meets it. If the new generation was catchment hydro or biomass it intrinsically meets it. It's really more of a challenge for the variable renewable energy generators, largescale ones such as largescale wind and

largescale solar. The market could've done that already, but it hasn't. Reliability is key. The market tends to look at the averages rather than the peaks. It was intended to deal with the peaks, so the design of the energy market has been such that the price signals to investors coming from the really high prices you get when there's a scarcity would say, "Look, you should build some more gas etc." It worked very well in the presence of growing demand, it worked very well in the presence of consistent technology, but it has been failing. It's a scarcity mechanism and it's –

AUDIENCE: Do you mean the energy market or the market in general?

ALAN FINKEL: Well, what other market are you talking about?

AUDIENCE: Creating a market for it.

ALAN FINKEL: Creating a new market for that would be a very bold experiment that I wouldn't see as coming in under the rubric of optimising the way forward. We don't have a growing market. It's steady demand. We're really looking at replacing exits of existing generators whatever they might be, and one day they'll be existing windfarms and exiting solar farms. We're talking about maintaining reliability. It's difficult to create a brand new market for a top-up entity, which is this reliability obligation, in a static growth situation. That would be a really bold suggestion.

AUDIENCE: We signed up to an emissions reduction target at Paris, but we also signed up to staying well under two degrees and leaving the door open to 1.5, which of course would require very, very rapid emissions reductions to zero and, in fact, drawdown. Was there any thought given to stress testing the model to look at whether it would fit with a much more rapid reduction in emissions?

ALAN FINKEL: We specifically were asked to look at security, reliability and affordability in the electricity market cognisant of our existing obligations. We were not asked to do an analysis again. An analysis has already been well done of the climate science. The country has made a commitment under the Paris Accord. What we have recommended is a framework, being a Clean Energy Target, combined with a national agreement to accept a trajectory into the future and a three year notice of closure. What we modelled was effectively the requirement to meet the Paris commitment. If that was accepted and we got going and if a future government wanted to adopt a steeper trajectory the framework is quite resilient. I would caution any future government to make any changes too quickly. So if the system was accepted and was in place and a government wanted to say, "Five years from now we're going to steepen the trajectory because we have a concern about cumulative emissions" the system is sufficiently resilient to do that, yes.

SABRA LANE: I think the Garnaut Review suggested any changes in emissions trajectory should be five years out, was it?

TONY WOOD: The actual author is here tonight.

SABRA LANE: Yes he is. Ross Garnaut, hello and welcome. Is it five years?

ROSS GARNAUT: In fact, nine. Not five years, it's nine.

TONY WOOD: Yes. The issue here is there's enormous uncertainty around how things are going to change and what the technology is going to be and you don't want your policy predicated on a specific forecast of that future. It needs to be able to adjust and that means that periodically you have to adjust it. You can set very good long term targets and then have short term targets which are firmer and gradually adjust those, which was largely what the Garnaut Review was trying to design and there have been other attempts to do the same thing. I think the question also relates to the issue of Alan's job was

to specifically look at electricity. That's 34% of our emissions. It's not the other 66% of our emissions. So we are left with the challenge of what we do about that. Alan certainly recommends that the government endorses a whole of economy target by 2020 to 2050, and that's where that debate will take place. It will certainly take place I think in the second half of this year when the broader Climate Review has to be undertaken.

AUDIENCE: Are the concerns for keeping the lights on drowning out the concerns of the climate scientists?

AUDREY ZIBELMAN: I really don't think it's an either/or proposition. I think that what we have to recognise is that, again, if we can move forward and think about how we integrate resources, better renewables and we can think about how we use the demand side better, the issues of security, reliability, price and the environment can be joined. I think this idea that you have to be concerned about the environment or you should be concerned about price and that you can't combine the two is really outmoded thinking and we need to move forward from that.

ALAN FINKEL: Can I also add in relation to climate science, a lot of people came to us and said electricity has to do the heavy lifting on behalf of the whole economy, but that's not a decision that we were asked to make and it's not even a piece of advice that is necessarily correct. The electricity sector is 34% or 35%, as Tony was saying. Agriculture and land use is 20%. There are ample opportunities through avoiding deforestation to meet at least the next decade's worth of commitments. There are ample opportunities in the transport sector, which is 18% of our emissions, through implementing efficiency regulations for vehicles to reduce the emissions in that sector and through the electrification of the transport sector. There are ample opportunities in direct combustion, like space heating, which is also another 18% of the emissions, through using electricity itself to replace gas for direct heating and when you use electricity with heat pumps it's an incredibly efficient way of using your primary energy sources. So I don't buy that for the next decade, in any event, electricity necessarily has to do the heavy lifting. Maybe it can, but if we rush the process in the electricity sector we run the risk of higher prices, lower security and lower reliability, so we need to optimise. We need to find the right balance.

TONY WOOD: The question about security is tricky because for those who want to create a scaremongering campaign that renewable energy is going to cause the lights to go out there's lots of fertile ground at the moment. We need to get on top of these issues quickly and I don't want to put too much weight on Audrey's responsibility here, but can I suggest that if we had a blackout in Melbourne next summer you can just about forget, for at least a while, a lot of the stuff to do with climate policy. So there is a hierarchy here and the challenge is to make sure we don't really test it.

AUDIENCE: One question to Audrey and one to Alan. Audrey, one of the good things about the Finkel Report is that it leaves lots of things to AEMO and we've all got great confidence in you, but the recommendation puts another layer on top of you. Will the Energy Security Board, with you or your chair just being one of five members and then a chair and deputy chair, help you to build this new flexible energy system for the future or not? To Alan, a lot of discussion about the cost of electricity and the Coalition party room seems to have focused on the cost of electricity being the reason not to do anything about reducing emissions. On the particular model that you used, what would be the effect of having a stronger target? Instead of reducing emissions by 28% to, say, reduce it to 30% or 35%, would that increase, lower or leave the same the price of wholesale electricity?

AUDREY ZIBELMAN: I'll answer the easy question! I really, first of all, appreciate what you said. It is the CEO and then the chair of AER and the chair of AMC as the three market bodies working with the Energy Security Board. To me, from the perspective of governance, it is very important that we get the direction and we can move things quickly. I think the idea of having a body that has got the delegated

authority to deliver and move and with the right kind of support makes a lot of sense. When I think about it these are really complex matters and to ask people who are busy politicians working on multiple issues to come across things and make decisions is really a hard task and often you have very conflicting priorities and things you have to think about. And if the COAG is willing to do that, I think it actually will become a real add to move things forward. But in the meantime I would say that AER, AMC and AEMO - Paula Conboy (AER) is in the audience and we're spending a lot of time working together because from our perspective many, many of the things that are outlined in the report are sensible things to do and we need to get on with it.

So regardless of whether we have an Energy Security Board or don't have an Energy Security Board, the folks in Australia who live this stuff every day, I can tell you we're working on it and we're trying to take the blueprint and turn it into a roadmap so that we can turn it into a real result. So we're on it anyway. I think though that having a board and having it work faster and better is going to be beneficial for everybody.

ALAN FINKEL: Before I answer your question let me just add to that. I agree with everything that Audrey said. The way we've recommended that the Energy Security Board comes into existence is through delegated authority from the COAG Energy Council and the intention is for it, through that delegation, to make the COAG Energy Council itself more efficient through its ability to bring together with that delegated authority the activities of the three energy market bodies, each of which is a terrific body but that added degree of co-ordination and the specific responsibility to drive the blueprint forward will make the whole system more efficient.

In respect of modelling what a steeper trajectory would deliver, at some stage you've got to ask how much do you want to know at the moment? It's a framework. I'm confident that as a framework it can be modelled and from the modelling one can get a result from the economic policy analysis and work with engineers like the MEI to do the security and reliability studies and determine whether it can be done. But we've got to look at what the needs are today and I feel that we've done the right model. Let me repeat that what we've recommended is an architecture. We've modelled a certain trajectory and governments can accept that as the parameters that they want to use in the initial adoption of the architecture or they can be more aggressive or less aggressive. If they're less aggressive it'll be hard for the whole economy to meet the Paris commitments. If they're more aggressive they've got to do that security and reliability analysis, because there will be consequences. They might not be terrible, they might be manageable, but there are consequences. There are always unexpected side effects. It's like medicine, unless you test it you don't know what the results are.

AUDIENCE: The system was going to deliver us lower costs, more efficiency and so on, yet it doesn't actually report wholesale prices. It reports a bit about retail prices. Is the new system actually going to give us a measurement of real costs to the end user?

ALAN FINKEL: Our report consists of three documents including the 212 page review, but an integral part of it is the Jacob's Group economic policy scenario analysis and the MEI stability analysis. You'll find a lot more information in the Jacob's report including the wholesale prices, but if you can recall the slide that I put up which showed inputs and outputs for the NEM, that's where wholesale prices exist. They're not the outcome of interest. So if you're using a credible mechanism to drive the trajectory, called an EIS, you get a certain impact on the wholesale price which feeds through to the industrial, small business and residential prices. If you're using the CET you get a very different impact on the wholesale price because the ultimate price that we pay as consumers, whether we're industrial or residential, is the combination of certificates from the scheme and the wholesale price. When you put them together it feeds through into the final price we find through the modelling that the CET provides a slightly lower price going forward than the EIS and between them, either of the provides a fairly

significant lower price than business as usual. But it's important not to confuse inputs and outputs with the outcomes that we're interested in.

AUDIENCE: We're a longstanding investor in renewable energy in this country and an ongoing investor, so as the sailor of a ship in stormy seas I wanted to thank you and the panel and congratulate you for all the tremendous work you've done, because I think the blueprint has laid out something that makes our job ever so slightly easier, so thank you. I think early on in the piece, it might have been around the time of the interim report, you were reported at least about making some comments on the relative long term merits of pumped hydro versus battery storage and other forms of storage. I wonder whether you or the panel have updated your view on that?

ALAN FINKEL: So the final question is do we have an opinion on pumped hydro versus batteries?

AUDIENCE: Yes. If I recall correctly, six or so months ago you made some comments around the relative merits of pumped hydro versus batteries and I wonder whether you had updated your view at all?

AUDREY ZIBELMAN: I can answer that. I think that one of the things that we're going to be learning in the next several years is how batteries, especially largescale grid batteries, work on our system. As many of you are probably aware, the Victorian government has announced a largescale battery product and so has the South Australian government. In one year we're going to have two of the largest largescale battery projects operating in Australia, which will give us quite a bit of information. But my experience in the US is that batteries provide a lot of good value in terms of frequency balancing of the system, particularly because they go up and down very quickly, actually faster than traditional generation, so they make the system operate much more efficiently and can be helpful in that way. What our concerns are going to be is not just about keeping the system in balance in real-time, but also what happens if we have a major storm and we have a large period of time where there are cloudy days or the wind's not blowing? In that context chemical batteries may not perform as well as pumped storage, which you can run over a long period of time. I believe that what we have to think about is that the grid itself is a system of systems and what we shouldn't do is say we just need one type of storage and not another type of storage. What you need to think about is how to optimise the system itself with all the various resources that are going to have different characteristics which, in combination, drive value.

TONY WOOD: The point about your question is that we've had experience in this country of designing policies based upon the accuracy of the forecast. The only issue is how wrong will the forecast be and the answer is by a lot. We got it wrong really badly before with the carbon price tax that Labor introduced which was based upon a forecast and within days it turned out to be grossly wrong and it left it open to attack and the RET was also based upon forecasts and we saw what happened with that. So the key here is to be very confident, as Alan described, that there are technologies that are coming down very rapidly and the main point about policy analysis designs that we do this is that it should be indifferent. It should facilitate the most efficient deployment of those technologies, whether they be for short term balancing or the longer term, they should be indifferent to what happens with those policies and let people like your organisation get on and find the lowest cost way of doing it.

ALAN FINKEL: Can I just add that when I talk about solar or wind or batteries or pumped hydro I'm just using them as examples, because none of our recommendations are technology-specific, they're needs-specific. I agree with what's been said, there are two things you need. You need storage, but you also need the essential security services, frequency control, for example. Pumped hydro can provide that. Batteries can provide that. Let the best man win, if I can just use the gender-specific traditional term. We need diversity. We need, to the extent that they can do it cost effectively, batteries

and pumped hydro. We also need diversity of sources, so just the combination of wind and solar is much better than having only a wind generation capability with renewables or only a solar generation capability because you smooth out the generation capability. And don't forget demand management. If your need is to deal with the peaks then being able to switch off large loads on demand is important and if your need is to deal with frequency control then being able to switch off large loads in milliseconds is important. There are so many different technologies that can be brought to bear to solve our needs or to meet our needs and our review talks about them all and recommends means that will allow them to enter the market most effectively, but there is no existing prejudice that I have or anybody on the panel has for one technology over another.

SABRA LANE: We could go on all night, but sadly we're not going to. Thank you very much everyone for coming out tonight to talk about this and thank you to our participants.

END OF RECORDING