T R A N S C R I P T

LEGISLATIVE COUNCIL ENVIRONMENT AND PLANNING COMMITTEE

Inquiry into Nuclear Energy Prohibition

Melbourne—Thursday, 25 June 2020

MEMBERS

Mr Cesar Melhem—Chair
Mr Clifford Hayes—Deputy Chair
Mr Matthew Bach
Ms Melina Bath
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Mr David Limbrick
Mr Andy Meddick
Dr Samantha Ratnam
Ms Nina Taylor
Ms Sonja Terpstra

PARTICIPATING MEMBERS

Ms Georgie Crozier
Dr Catherine Cumming
Mr David Davis
Mrs Beverley McArthur
Mr Tim Quilty

WITNESSES

Dr Mark Ho, President,

Mr Robert Parker, Vice-President, and

Dr John Harries, Secretary and Public Officer, Australian Nuclear Association *(all via videoconference).*

The CHAIR: I declare open the Environment and Planning Committee public hearing for the Inquiry into Nuclear Prohibition. Can I just remind everyone that all mobile phones should be turned to silent and that background noise is minimised, particularly members and witnesses who are joining us on Zoom; they should mute themselves unless they are speaking. All evidence taken at this hearing is protected by parliamentary privilege, as provided by the *Constitution Act 1975*, and further subject to the provisions of the Legislative Council standing orders. Therefore the information you provide during the hearing is protected by law. However, any comment repeated outside the hearing may not be protected. Any deliberately false evidence or misleading of the committee may be considered a contempt of Parliament. All evidence is being recorded, and you will be provided with a copy of the transcript following the hearing. Transcripts will ultimately be made public and posted on the committee website.

I would like to formally welcome our witnesses for this session: Dr Mark Ho, Mr Robert Parker and Dr John Harries. We really appreciate you giving us the time to share your knowledge with this committee. We allowed 5 to 10 minutes for an opening submission. We have got 45 minutes so members will then be able to ask questions. I will be guided by you. Who would like to kick off?

Dr HO: I would like to open with an opening statement. I will keep it very short. Thank you, honourable committee members. My name is Dr Mark Ho and I appear today as President of the Australian Nuclear Association, an independent scientific institution whose members represent a range of professions, including nuclear scientists and engineers. The ANA advocates for the peaceful, safe and effective use of nuclear technology and engages in regular discussions with the public, industry and government on the safe and effective use of nuclear science and technology. We conduct this work as volunteers and the membership of the committee has no paid positions, thus we would like to declare that the statements we are about to make are our own, independent of businesses and institutes we might otherwise represent. The ANA supports the continued prosperity of the commonwealth of Australia, which is underpinned by a strong industry and a plentiful supply of energy.

The ANA believes our industry should grow in an environmentally sustainable and responsible manner. To this end, we think nuclear science and technology, especially in the form of nuclear power generation, has much to offer. It is outlined in our written submission to the committee that the ANA supports uranium mining and the introduction of nuclear energy in Australia as a robust pathway for decarbonising Victoria's energy sector and to ensure continuity in delivery of power when coal-fired power stations such as the one in Yallourn are retired.

Today Victoria's electricity is predominantly powered by coal to the tune of about 80 per cent of the state's electricity. However, with the continued pressure to decarbonise at home and abroad the state must look at alternatives such as nuclear energy to ensure coal's replacement is similarly robust and economical, but at a much lower carbon emission. The ANA believes nuclear power can contribute to Victoria's energy mix for the following stated reasons.

Nuclear power provides clean, zero-emissions, dispatchable electricity generation. Nuclear is the only current low-carbon, non-storage firming option for intermittent wind and solar generation. Nuclear power plants are concentrated thermal plants which maximise current grid infrastructure and minimise expensive grid build outs. Nuclear has a capacity factor of up to 92 per cent, meaning it is nearly always on. And with an operational life of 60 years or beyond, the longevity of nuclear plants outcompetes all other forms of energy generation. Nuclear power is tightly regulated by law and must account for its waste, which again is small for the amount of power it generates. Small modular reactors promise lower capital costs and reduced construction times, in sizes that are suited for many parts of the Australian grid. New types of nuclear power plants are also engineered to load follow with intermittent wind and solar generation. So it is for these reasons that nuclear power is a key component of many countries' plans for a clean energy future with low, low carbon emissions.

With around 440 reactors operating in the world today, nuclear power is a proven form of clean and reliable electricity generation. Every year Australia exports enough uranium to nearly power the whole of the national electricity market, yet federal and state legislation prohibits its use and consideration. The recent federal and New South Wales parliamentary inquiries into nuclear power have found nuclear energy to be a reliable low-carbon source of electricity generation. We hope the evidence we and others present will lead the committee to the same conclusion. With that I would like to hand over my opening remarks to ANA Vice-President, Rob Parker, who will speak a little bit more in depth of nuclear power's merits. Thank you.

Mr PARKER: In the last couple of days I sent through a request that perhaps we refer to the submission from Nuclear for Climate, and there are a number of figures that I was going to refer to. Do you have figure 1 of the submission available, please?

The CHAIR: While we are trying to raise that, please take us through it.

Mr PARKER: Okay. In that submission we compared the emissions intensity of two nations that are coming to grips with low carbon pathways. They share a common border—one is Germany, one is France. Day by day, week by week and for the last 40 years we have seen the French emissions intensity set at around about 30 to 40 grams of carbon dioxide per kilowatt hour. Their near neighbour in Germany formerly was a nuclear enthusiast but now they are winding back their plants. Despite that, and despite spending €125 billion up until 2015—and they are now going to be in debt to the tune of €520 billion by 2025—their emissions intensity as they attempt to use variable wind and solar replacement is actually not achieving the types of results they had hoped. They steadfastly keep their emissions high at around about the 300 to 400 grams, or around 10 times that of the French system. This is an important lesson for Australia.

Two weeks ago the Germans opened up another coal-fired power plant, Datteln 4. They have got a 1200-kilometre, 1200-millimetre pipeline coming from Russia, and that is going to carry gas into their system. They were having a lot of trouble maintaining their energy security as a large industrial nation. We need to be mindful of that.

The second graph, which was figure 2, where we looked at model ranges of emissions intensities for different models on our NEM. Now, this modelling was done in collaboration with Dr Robert Barr of Electric Power Consulting, and in that modelling—and I will not go to all of them, but just briefly—we looked at the costs, the current NEM costs, and our emissions intensity. It is up around 820 grams of carbon dioxide per kilowatt hour, and we have got a general market value of around about $65–$70. That is the traded value of electricity on the NEM. When we looked at very low carbon emissions scenarios using nuclear we found in one of our results—case 7—that, yes, we ended up with about a $10 increment over our existing system but we ended up with an emissions intensity of about 40 grams of carbon dioxide. And that system involved the use of solar through the day. It also involved the use of our existing hydropower in the Snowy. It involved a very small amount of gas, and it involved the best part of 80 per cent nuclear going into our system. We then modelled systems using renewable energy, and when we tried to emulate that, when we tried to get down around the 50 grams, we found that our costs for electricity were getting up in the region of $300 per megawatt hour as we tried to do that. And so the cost effectiveness under our modelling showed that it is not a profitable route for Australia to go down.

We also included a graph which shows in figure 3 there is a societal angst, of course, that nuclear is an unsafe technology. We looked at the types of fatalities per unit of output, and when one actually looks around the world at that you find that nuclear is about our safest form of electricity generation on the planet. It is much safer certainly than coal and hydro, and it parallels similar outcomes for wind and solar. We then went in and we had a look at the materials intensity. People are mindful, in this age of using excessive amounts of materials, that whatever we replace it with—our current system—has to be sustainable. We find that when you look at things such as solar it is using about seven times the amount of non-renewable resources that a nuclear power plant does. Wind is up around 10 times. If you add in the extended grid and batteries and storage, you can well have a multiplier of about 20 fold. So in terms of low environmental footprints, nuclear is probably about the best source of energy that we have.

Finally, we looked at the current price of nuclear power plants. We went to South Korea. We have had a look at their industry. We have also been mindful of recent studies done by ETI—that is United Kingdom Energy Technologies Institute studies—and what we are finding around the world is that the base price for current

generation III/III+ nuclear power plants under properly regulated and planned systems is of the order of US$4000 per kilowatt. If we translate that to Australian dollars, we are looking at values around about $6000 a kilowatt. At that price point and about a 6 per cent discount rate, we see that nuclear is currently competitive in our wholesale energy market in Australia.

Therefore, finally, the recommendation we come up with in our study were similar to the ANA's central study: a repeal of the *Nuclear Activities (Prohibitions) Act 1983* and to work with the commonwealth government to repeal other legislation that prevents the use of nuclear power in Australia, in particular the ARPANS and EPBC Acts. To implement nuclear power in Victoria within the Latrobe sooner rather than later, it is our firm view that the existing generation III and III+ reactors have a place right now within the state of Victoria and they can be supplemented by small modular reactors as and when they occur, but we should not be waiting to get on with the job of reducing our emissions intensity.

It is recommended that we also in Australia investigate the use of nuclear fuel storage for nations around the world and then finally, we need to set up training facilities within the state of Victoria to train tradespeople, engineers and scientists in nuclear skills. Thank you.

Mr LIMBRICK: Thank you very much for appearing today and thank you for your submission, which was very detailed and had lots of interesting information which I am sure the committee will find useful. Mr Parker, you mentioned the Latrobe Valley. We have talked about that once already today when we had the CFMEU appear this morning. Do you think that is a suitable place for building a nuclear power station? There have been concerns around social licence about, 'Would people accept it replacing coal power stations?'. I have also heard other concerns about water consumption and this type of thing and that might be a problem. Maybe you could elaborate on some of those potential perceived barriers to replacing our coal generation in the Latrobe Valley.

Mr PARKER: I would not dismiss any of those concerns. We visited the Latrobe Valley. We have had a look at the water. We have got a substantial number of existing coal generators in the Latrobe Valley. Modern hybrid cooling systems with nuclear power plants have significantly reduced the water demand. In any modern study into nuclear power plants one would look at a proportion of dry and wet cooling operating together to minimise the water demand, keeping in mind that there is already a substantial water demand with the significant number of plants that are there already, so it would utilise an existing resource but not increase its use and would probably reduce that demand because of modern cooling systems.

Yes, social licence is an issue, but one of the great resources of the Latrobe Valley I became aware of when we spoke to union groups within the Latrobe Valley and also with the Latrobe City Council—I became incredibly aware—was the huge human resource in the Latrobe Valley, the trade skills. I became aware of what we are seeing in some towns such as Morwell: increasing destabilisation as a result of the winding back of the coal plant and that there is increased economic pressure on those communities. We could revitalise those communities. We could certainly lift up the technical skills, and we could bring pride and creativity into the Latrobe Valley through the use of nuclear energy, because it would really lift the bar of achievement for a very clever group of people. I really am distressed that in the long term we could see those sorts of skills thrown on the scrap heap.

The CHAIR: Before Ms Terpstra, can I just remind members we extended time so we have got till 12.30, so no pressure.

Ms TERPSTRA: Thank you very much, Chair, and I would just like to thank all of you for your submissions this morning. It has been quite interesting. My question is: I was just referring to notes about a 2015 report by the International Energy Agency and the OECD Nuclear Energy Agency that predicted that electricity from SMRs would be potentially 50 to 100 per cent more expensive than that from large reactors, so what do you say to that? That is the first part of my question. Also, there has been some concern linked to the production of SMRs. I understand there are only a handful of them under construction at the moment but potentially there are concerns about nuclear proliferation connected with the growth and development of SMRs, so what do you have to say to those two things?

Mr PARKER: I will just mention it briefly, because Mark is particularly skilled in this area, so I will just come to the first one. I note the date of the report is 2015, but subsequent to that we have got the NuScale plant that is firming up their numbers. But we have had the entry recently of General Electric—one of the world's

most respected engineering companies in terms of nuclear and also turbo generators—where they are taking some of their existing stock-standard generators with an existing design. Those reactors are being designed to be competitive with renewables and with gas turbines in the United States. Under those scenarios they are much lower cost than we would see in Australia. So time moves on and we are seeing tremendous benefits moving on there.

On nuclear proliferation and the used fuel from nuclear power plants, there is no record out of these pressurised water reactors and boiling water reactors of the type of fuel being used. If one wants to build a bomb, there are much easier ways of doing it. We must be mindful that all nuclear plants are signatories to the IAEA and are subject to continued inspections at any time of the day, anywhere, and ANSTO undergoes this in Australia. These things are sealed units, and IAEA inspectors can come in at any time. The fuel out of those is a terrible way to try to go towards weapons manufacture. There are other simpler, direct ways that people who want to go down that route go. I will leave it to Mark then.

Dr HO: Thanks for that question. I think the question of cost is always something fit to be raised, but the figures that you suggest are representative of what the picture now is—those figures are from 2015—and the fact of the matter is that in SMR land, the amount of R and D and effort put into SMR has actually accelerated their implementation. Continuing on from what Rob Parker has said, certainly, for example, for the overnight costs of, say, the NuScale reactor, they are quoting first-of-a-kind plants at US$4350 per kilowatt of capacity, and that would be falling down to $3600 after many plants have been built. Because people have to understand that the idea with SMRs—the reason why they would be of lower cost—is that they would be factory constructed, and so therefore you can increase the quality and decrease the unit price from building many of them, similar to, say, in an aircraft industry. The other design, the BWRX, for instance—the plant's proposed 300-megawatt output would be less than US$1 billion, for instance. Again, these plants are of the type that would be competing with, and also working in harmony with, renewable energy sources.

I would also like to stress why we are doing energy transition and why we are thinking about low carbon: it is because we want to do something about reducing carbon emissions. I think we really should think about tackling the problem and not just picking winners and saying, 'It's going to be all renewables or all nuclear'. The new energy mix will indeed require all de-carbon or low-carbon sources.

With regard to some of the higher estimates of SMR costing, I would think that those are probably reliant on some of the SMRs that are implemented currently. I know, for example, the first-of-a-kind floating or barge-mounted SMR, the *Akademik Lomonosov*, has been commissioned over in the Russian town of Pevek, in the Arctic Circle. I mean, that project was under development for many years. So I would say that the high cost is really due to the development costs of that reactor being wrapped in as the base costs, and I do not think that is really representative of what the true picture is. For example, there are other very exciting SMR projects such as the HTR-PM over in China, the high-temperature gas reactor. That has high estimated costs as well, but again those are due to the fact that it is a first-of-a-kind reactor development and those systems have the promise to be deployed in the interior of China, where you have, you know, water conservation for instance.

So I would say that SMRs are something which are under development worldwide and there is a billion dollars being spent—both in private and public investment—and these are very real technologies. They are being supported by government and industry in the US, Canada, Great Britain, France, China, Russia. All the bigger industrial countries are looking at SMRs and nuclear generation'.

Ms TERPSTRA: Just a bit of a cross-section across any of you there: do you think that the nuclear sector should be more highly regulated by government or should there be less regulation of the sector?

Mr PARKER: Australia already has a good regulator in place. The role of that regulator can be expanded to encompass nuclear regulation, so I think Australia is very well placed with its existing regulation base. We are a founding party to international treaties on nuclear power plants, and we can continue with that initial founding and expand on that. Mark or John, if you would like to carry on, please.

Dr HO: I will let John have a go.

Dr HARRIES: You can have a go, Mark.

Dr HO: Look, I think nuclear regulation is extremely important. I mean, this is a very high-tech, complex piece of equipment and also, you know, any kind of movement of nuclear materials or use of nuclear materials for energy generation, they all have to fall in line and abide by the established international treaty. I think that Australia is actually a very high performer in our region for observing safeguards. It is appropriately regulated by ARPANSA and there are safeguards and oversight for it, ASNO. So I think that, should Australia have nuclear power, those government entities could be expanded to incorporate that fairly well.

Ms BATH: Thank you, gentlemen, for your presentation today. I want to flag that my electoral office actually sits in the heart of the Latrobe Valley, so I concur with you that there is a tradition of engineering and an amazing array of expertise still there now. At the moment there is a danger, or an eventuality, that it may leave—people may have to go elsewhere—and we want to continue to see expert people doing a fantastic job in a whole range of innovative ways in the Latrobe Valley. On my question, nuclear power plants and SMRs et cetera cost money, and I would like you to go through or expand on your views about what that looks like. Who are the market players overseas—industry, corporations, or is there a mix of public and private partnerships?

Mr PARKER: I might just kick off briefly on that because I have been overseas and have had a look at different vendors. I will start first with the generation III and generation III+ large-scale reactors. Australia would be ideally placed to team up with South Korea, who have got an established track record as being one of the most disciplined and fastest deliverers of large-scale reactors for export markets. They have just done four new power plants in the United Arab Emirates, and they have got an extremely disciplined, tight, vertically integrated delivery program for the equipment.

The equipment that goes in that would need to be imported into Australia for large-scale reactors—what we call the really high-tech stuff—is about 20 per cent. The remainder of it could come from Australia, and here we are talking about things like reinforcing steel, concrete, normal civil engineering and a lot of mechanical pipework and what we call non-safety-related valves. So there is a tremendous ability for Australia to gear up for large-scale reactors, especially in a place like Latrobe. Because we have got to remember that Latrobe has got a grid connection between Latrobe through metropolitan Melbourne, and the best part of 5 or 6 gigawatts.

I would nominate Korea as the first place to kick-off, and we are dealing with an equal kind of partner in terms of our exports to them and imports. After that, in practical terms for large reactors, we have China, who currently are not flavour of the month but have got a very good industry, and we have also got Russia. France was traditionally a very good deliverer of reactors, but their power plants are probably a bit too large for Australia, so we need to keep an eye on it.

Coming down the road very quickly, and probably a decade after those, are the SMRs. We have got General Electric and we have got NuScale as probably the two leading SMR deliverers in the near term, and we would hope to see them in about a decade. We already deal very intensively with General Electric. They have got an office sitting in Melbourne. They are marketing the types of turbines that would go into these all the time, and so all we would have with something like a General Electric nuclear power plant would be a hole in the ground for a single SMR—a single modular reactor—linked to conventional equipment that the people in the Latrobe are already familiar with. So I would be looking at those two vendors. NuScale and General Electric would be fertile places for us to investigate collaboratively. Thank you.

Dr HO: I just might add to that. I would agree with Rob's statement by and large. I think that SMRs are actually quite a near-term prospect, probably below a decade. The first of the kind at NuScale are scheduled to be completed by 2026. We heard earlier that the NuScale reactor design is undergoing a Nuclear Regulatory Commission design certification, which would be completed by the end of this year. What I want to kind of impart on the committee is the feeling that these SMR projects are truly well costed plants that are going to be going in very, very much in the future. So if Australia were to contemplate to have nuclear power, then we should contemplate lifting the ban on the use of nuclear power so that we ourselves can do the prep work in order to possibly consider having those SMR plants in place within a decade.

Ms BATH: This is sidestepping to a different issue, Mr Parker, you discussed the tables. We do not have access today to those tables, through no fault of anybody, but you talked about nuclear being a highly safe production and you related us to some tables. I am interested in the parameters of measurement. Elaborate on how that was deemed or how you made that judgement.

Mr PARKER: Yes. Thanks for that. The judgement was made upon the number of deaths that have been recorded in the nuclear power plants from industrial accidents—for example, people falling from cranes right through to radiological accidents or any workplace accidents that occur around these different areas. So nuclear, because of its extremely high levels of regulation, has been subject to intense scrutiny. Probably the worst example that we are all aware of is that of Chernobyl, which was from a nuclear power plant that would never have been built in the West. It was, if you like, the equivalent of the Comet 4 jet airliner, which had its demise, and we went on to more modern types of aircraft. And so we have done with things like those RBMK reactors in Russia, which did not have containments—all western reactors have containments. We have seen in the fullness of time that containments have done their job and they have contained the material when there were nuclear excursions. It comes down to deaths lost per terawatt hour from any source, and it took into account all of those through Chernobyl. Does that answer your question?

Ms BATH: Yes, thank you.

Mr MEDDICK: I have got a few questions here. I will hopefully rip through them as quickly as possible, so if any of you want to answer them, feel free to jump in. I am not directing them to anyone in particular. I thank you all for coming and for your submission. The first couple are around modelling. Let us say everything goes the way you would like to see it go: we have an expanded industry, we lift the moratorium and we start to do these things here in Victoria. Is there any research on, first of all, the locations of deposits for uranium and thorium to supply that industry, and have you done any work or any modelling on how much land will be affected in terms of habitat loss from that expanded mining industry? Secondly—the other modelling question, and I will come to the others later then—you talked about renewables, as wind and solar particularly would have to have an outcome of $300 per kilowatt hour. Is that based on current infrastructure or expanded wind and solar infrastructure at that point in the future?

Mr PARKER: The first one we will go to is the expansion of the uranium industry to suit Australian nuclear power plants. There is currently a glut of uranium in the world in terms of mines and industry to produce it into fuel. For the numbers of reactors that one would see in Australia, I would not anticipate an expansion of the uranium mining industry to serve those. There is a significant amount already, and one would not necessarily see an expansion of uranium mining or any impact on the environment through that source.

Your second question was in relation to SMRs and the cost we have got—and I would suggest perhaps we could look at OECD studies on this issue. When we put more and more renewables into our system, we need more and more grid. We need to expand the grid to address all of those. Please keep in mind that currently in our electricity bills about 50 or 60 per cent of an electricity bill is to do with transmission and distribution. Electricity generation only counts for around 28 per cent. Generation is actually a smaller portion than these larger things, and what we are talking about with renewables of course is dramatically increasing the transmission and distribution. So you are going to gear up something that is already large and accelerate that. That is where our increased costs will come from.

In addition to that, we have some exceptionally fast what we call ramp rates. Where wind falls or solar falls—for example, if clouds come across Melbourne and you suddenly lose 3 gigawatts of energy because of cloud cover or you lose the wind—you get this massive ramp rate that you are getting with renewables. The more we put into the system, the more these ramp rates will increase. To meet those ramp rates we are going to need more and more gas turbines. We are going to need more and more sophisticated hydro pumping storage and more and more system services to basically keep the voltage and the frequency stable on the grid. Add all of those bits in, that is where you get this cost increment. That is what is the Germans are finding, because they have got the second-highest power costs in Europe where they are attempting to do it and it is not working.

Mr MEDDICK: Thank you. I have just got two very quick ones then. You mentioned the international treaties that are around nuclear power production. Given that Australia actually has an incredibly poor record in terms of conforming to international treaties and that we have a very bad habit of fudging the figures in terms of the Paris accord and those sorts of things, how confident are you that we would actually be telling the truth around what we would be reporting to these international treaties?

And the other then is just a very quick one, in that respect. You talked about the deaths—you have counted up the deaths in the industry—but you only mentioned the accidents. Do your figures include the deaths of

employees from long-term exposure to those reactors or power plants that have been in existence for a long time but have not suffered an accident per se like that?

Dr HO: I just want to clarify your question, actually. When we are talking about abiding with international treaties with regard to nuclear actions, Australia is a star performer if you look at all the records, and it has got nothing to do with whatever our position is with regard to abiding with the Paris treaty or Kyoto. I just want to make that clear, and I am going to comment in that regard. I am here representing the Australian Nuclear Association, talking about the technology. But the other question of the mortality rate from a generation of nuclear energy, I am going to pass that on to Rob.

Mr PARKER: Okay. Within a nuclear power plant the workers are continually monitored; they wear monitors which are checked at monthly, weekly, intervals. There is a significant database on the actual radiation that workers in nuclear power plants receive. It happens that workers in nuclear power plants are probably exposed to less radiation inside the power plants than people outside. They are incredibly well shielded, and it is an incredibly tightly regulated industry. I have probably read 26 or 30 papers looking at the long-term health impacts on people working in the nuclear industry, and there is no evidence that one can see of any long-term health exposure due to working in the nuclear industry. There are very well-regulated levels of radioactive absorption that those workers cannot exceed, and should someone ever reach a higher level, they would depart the industry and would be well looked after. But that does not occur, and I have looked at the industry, particularly in France, where I looked at the regimes there. There is no long-term health impact for workers in the nuclear power plant industry. It may be different, of course, in defence industries and other things, but they are not aligned to the civil nuclear power industry.

Dr BACH: Thanks, gentlemen. I will just ask a really quick one in follow-up to your question, Mr Meddick. I share Mr Meddick's concerns about worker safety, and I was very interested by your response just then, Mr Parker. I do know that some older studies—and indeed an earlier conversation that we had as a committee just this morning touched on this issue—refer to some of the broader matters that you just raised, Mr Parker. Could you please point us in the direction of some of these studies that you say you have read? If indeed that is the case—that, as you say, the evidence is that currently, given the state of the industry today, there are no long-term health implications—well, that would be very gratifying and useful information for us to have as a committee. Could you take that on notice and perhaps come back to us?

Mr PARKER: Yes, I will. I will send to you the database of these studies that look at the long-term health impacts on workers.

Ms TAYLOR: Thank you for your contributions. I was just wondering about the cost issue, because we probably all have different perceptions of safety, so we may not come to agreement on that. I understand, for instance, with the Hinkley Point power plant, the costs on that just blew out inordinately, and that is a pretty recent production. It does not give us a lot of confidence, because that is a First World plant. At the same time SMRs are promised to be this wonder for the future, and yet there are no guarantees that they are not blowing out and prototypes are blowing out as well. Where is your confidence that something is magically going to change in this market that we are not seeing currently?

Mr PARKER: If I may just quickly come to that, I was looking into this in detail yesterday. If we take the groups of reactors that are being commented upon, currently around the world there are 55 nuclear power plants under construction, okay? They are being built in places such as Egypt, they are being built in Turkey, they being built in Pakistan and they are being built in Bangladesh right now. We must be mindful that places like Bangladesh are not wealthy. They are not spending a fortune and they are not incurring a large debt for these nuclear power plants. In places such as the United Kingdom and France we are seeing Western nations coming back into the industry, building the first one or two reactors as they rebuild their nuclear infrastructure to get back in it. That is the issue we are actually seeing, and we are seeing outliers in the group of 55. We are talking there are about four or five reactors of a nuclear power plant sitting in the background of the 55 that are being built. The ETI study from the United Kingdom has looked in detail at that, benchmarked what is happening, and they have looked at 33 recent power plants, picking why some go wrong and why some go right. The single largest thing is the recommendation of building multiple reactors at one site, for example, so that you get improved economies by building more and more in the same locale. But I will hand over to Mark.

Dr HO: That is a very good question, and there is a good reason for why the strike price for the electricity generated over at Hinkley Point C is pegged at £92.5 per megawatt hour. That is because the UK government at a point in time wanted to externalise the risk of any delays in construction to the builder, which is AREVA. Otherwise an analyst in the market has shown that the true cost is actually about £50 per megawatt hour. The reason why these costs vary is just the manner in which the financial structuring was put in place, depending on the amount of government support, the financing. When I am talking about that I am talking about the degree by which these projects are assessed in terms of their risk. So if you get, say, government-backed loan guarantees, you might be looking at about a 3 per cent annual interest rate, which is what Chinese and Russian large PWR builds enjoy at the moment. This is the whole reason why we are seeing so many reactors being built in China and Russia and elsewhere, because it is a technology which those countries view as low carbon, robust, long term and actually extremely profitable once they are built.

From the Western perspective, given that there have not been many built, as Rob Parker has said, the West is now forming up and restrengthening nuclear supply chains. The key is actually in having a very, very strong nuclear supply chain in order to roll out large amounts of cheap, reliable, low-carbon electricity. I think that in some ways we are very far from the rest of the world. We do not hear about a lot of the progress that is being made both in the West and in China and Russia's nuclear builds, but there is a lot of money being spent in near-term and future nuclear power tech and I think Australia is well positioned to benefit from that capital going in to R and D. But of course at the moment we cannot possibly consider it because we have got these state and federal bans on nuclear power.

Ms TAYLOR: I would just proffer that perhaps governance arrangements, are they equitable across the globe?

Mr PARKER: Sorry, could you clarify what you mean by governance?

Ms TAYLOR: Governance arrangements with management of the nuclear facilities, are they equitable across the globe? Does everyone have the same rigour?

Dr HO: Oh, yes, I believe so because the IAEA inspectors regularly inspect nuclear power plants. There are national regulators around the world. Nuclear regulation is always improving as well from each accident. Everything goes under review; everything gets shut down. For instance, at the moment many reactors in Japan are shut down and they are undergoing safety reviews. Nine reactors, having gone through that very thorough review, have been actually switched back on because the Japanese know they are actually spending lots of money importing gas and coal and they would still very much like a lot of nuclear power.

Ms TAYLOR: So governance is the same everywhere in every country across the globe, and you can guarantee that 24/7, 365 days a year, governance is absolutely the same—the regulation and the net outcome, absolutely the same?

Mr PARKER: Well, could we just clarify that nearly all plants around the world, the owners of them are signatories to the IAEA inspectorate. The IAEA inspectors can turn up at any of those plants at any time and inspect and look at the auditing trail of all the fuel and all the processes. So that is, if you like, a rigour that governments and the operators of those plants sign up to. They are instantaneous inspections without any prior notification. They do not get a call saying, 'We'll be there in a week'. You can get a knock on the door. ANSTO can get a knock on the door at 2 o'clock in the morning to say, 'We're here to look'. They do not get any notification. We have already got that in Australia. In addition to that, there is the World Association of Nuclear Operators. That is another level where operators go around plants—experienced operators. They go around to plants all around the globe and they sit with the operators and they go through all of their procedures, checklists and mechanisms for operation. Then they come up with an audit trail and recommendations for improvement, because in all these systems people always have failings, and they look at recommendations on how to improve the operation of plants. So this is a mechanism that all plants who have signed up to the IAEA and WANO operate.

Now, other varieties—you asked a very strong question—I am describing to you the processes they work by. Can I guarantee a reactor in X, Y, Z location? No, I cannot. All I can do is describe to you the processes that are in place to regulate these.

Dr HO: Sorry, I will just add to that.

The CHAIR: Just very briefly, Dr Ho.

Dr HO: I say in direct reply to your question that it is obviously not the case. For instance, in Russia they are still running the graphite-moderated, water-cooled reactors, which are the same type that operated in the Chernobyl nuclear power plant. But of course these reactors are not licensed anywhere in the world and have never been switched on anywhere else in the world. So in direct answer to your question, no, the licensing regime and the regulator are actually not the same around the world.

Mrs McARTHUR: Thank you, gentlemen, for your comprehensive presentation. Given the countries around the industrialised world—and you have even described now the developing world—which utilise nuclear energy in their energy mix, what are the economic costs, the industrial knowledge costs, the social costs of Australia not including nuclear energy in our energy mix, especially if we want to continue on the path, well-founded or not, of reducing emissions? Secondly, given that we have been in the nuclear wilderness for a long period of time and given that the expertise has been developing everywhere else in the world, are we able to piggyback on all that work that has been done, therefore reducing the costs, if we were to go down the path of nuclear energy in this country and benefit from that R and D which we have not invested in?

The CHAIR: Is that a question we can take on notice? Is it going to be a long answer? I will leave it to you. This is quite a good question.

Mr PARKER: I was going to suggest, Mark, we might both have a go at this one. The nuclear wilderness piggyback issue you might like to address, Mark.

Dr HO: I think ANSTO, for instance—Australia's national nuclear laboratory—has a broad range of skills across the complete nuclear fuel cycle: expertise in mining, expertise in the responsible and safe disposal of radioactive waste, for instance. I think at the moment the synroc—synthetic rock—plants to sequester basically radioactive waste, the pilot plant is under construction. So we are not really in the nuclear wilderness, so to speak. And actually, in fact, adding on to the argument that nuclear energy and nuclear technology can contribute and enrich Australian industry, that is absolutely the case. A lot of committee members might not know that metal fabricators actually in Australia fabricate reactor parts for the US because they have the relevant ASME qualifications to do so. And should we have small modular reactors, for instance, we can definitely work our way into the supply chain internationally.

Mr PARKER: I will bring up the other points you mentioned, which were economic, industrial and social issues. Just briefly—

Mrs McARTHUR: Or the costs—the costs of not going down the nuclear path.

Mr PARKER: Okay. The costs of not going down the nuclear path worry me incredibly because, in particular, when I visited the Latrobe Valley I looked at those workers, I looked at their skills base and I looked with considerable angst at that skills base not being available in the future. They are people with particular pride and skills, and they have to be cared for. They are a massive national asset that we have to look after. Victoria has been the powerhouse of Australia's industry and it must be protected, and nuclear is a tremendous way of doing that.

So the cost of not deploying nuclear is massive because we already read within publications for AEMO, in terms of the way in which they want to integrate renewable energy into it, they are now looking at radical issues around demand management. Demand management is a really soft term. Everyone thinks, 'Yes, we've got to do that'. Demand management means turning off the aluminium smelter. It means turning off a steelmaking plant at a critical time. Or it means telling the operator in an industrial facility that he cannot have 100 per cent power—he has got to go for 70 or 90 or whatever is available, or he has got to structure his production around different hours. All of that comes at a cost. When your competing nation can offer 100 per cent availability of power and all we can offer is dribs and drabs to suit the intermittent variability that is coming out of our system, we are in deep economic decline, and that worries me intensely. So if I had to pick one of the greatest long-term risks to Australia, it is not providing long-term energy security for the wealth of the nation, and Mark brought that up earlier. That flows on therefore to the social decline that we can also see in some of the wonderful communities in the Hunter Valley and also in the Latrobe. I will leave it at that.

Mr LIMBRICK: I would like to just briefly take up something that Mr Meddick brought up, and I think it is very important issue. We talk a lot about climate change and the possible benefits there, but also habitat loss. How does nuclear energy in terms of land use compare with other energy sources and therefore the requirements of land, and therefore habitat loss?

Dr HO: That is a terrific question, I think. To give everyone a simple comparison, we were talking about the Hinkley Point C nuclear power station earlier. In that site there will be two European pressurised water reactors generating, I think, 26 terawatt hours of electricity a year. To get the same amount of energy out of that nuclear power plant would require something in the order of 1000 square kilometres of windmills or 600 square kilometres of solar panels. So in terms of real estate nuclear power plants definitely have a very, very small footprint because the nuclear plant itself would be 4 square kilometres in terms of land area. For large nuclear power plants, of course, they have something called an EPZ, or emergency planning zone. That is something of a 16-kilometre radius, around which should be lightly populated. That is the standard kind of way that these plants are situated in the US. But with the new kind of small modular reactors, because they have got a much smaller reactor core and because they use passive safety systems, which are automatic, the NRC—which is the Nuclear Regulatory Commission in the US—has ruled that the EPZ, or the emergency planning zone, can be shrunk to the site boundary of those SMR plants. So that will allow those SMR plants to be more flexibly sited, with the minimum amount of land footprint.

The CHAIR: Gentlemen, thank you very much for your time. We really appreciate it. It has been worthwhile. I just remind you, some members of the committee might have further questions. They will be sent to you via the secretariat, and we will really appreciate it if you are able to provide a response. That will have the same weight as all evidence; it will be treated exactly the same way. So thank you very much.

Witnesses withdrew.