TRANSCRIPT

LEGISLATIVE COUNCIL ENVIRONMENT AND PLANNING COMMITTEE

Inquiry into Nuclear Prohibition

Melbourne—Friday, 14 August 2020

(via videoconference)

MEMBERS

Mr Cesar Melhem—Chair
Mr Clifford Hayes—Deputy Chair
Dr Matthew Bach
Ms Melina Bath
Mr Jeff Bourman
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

WITNESS

Mr Simon Brink.

The CHAIR: I declare open the Environment and Planning Committee public hearing for the Inquiry into Nuclear Prohibition. Again I ask that mobile phones be switched to silent and that background noise is minimised. I would like to again welcome my colleagues, the committee members: Mr Limbrick, Ms Terpstra, Ms Taylor, Mr Hayes and Mr Meddick, and some other members may be joining us later during the proceedings. I would like to welcome our next witness, Mr Simon Brink. Thank you very much for making yourself available and joining us today. We really appreciate that you are giving us the time.

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 this hearing is protected by law. However, any comment repeated outside this hearing may not be protected. Any deliberately false evidence or misleading of the committee may be considered a contempt of Parliament. All evidence is recorded and you will be provided with a proof copy of the transcript following the hearing, and the transcript will ultimately be made available on the committee's website.

We have allowed around 5 minutes or so for you to do an opening statement, and then we will go to questions. We are running slightly behind schedule, so we have got about 45 minutes and we will see how we go. We have received your submission, so members have read your submission. So if you want to take us through some of the points you want to emphasise, that would be great, and then we will go to questions. Mr Brink, we are all ears.

Mr BRINK: Fantastic. Thank you very much for the opportunity to give evidence at this inquiry. Firstly, I work for Museums Victoria. My day job is restoring the Great Melbourne Telescope. But I have also been involved with I guess the emerging energy technology sector for perhaps the last 15 or so years.

I guess I sort of started off with a bit of an environmental background, but my perspective on the climate change issue in particular is around if we are going to make some significant differences, given that Australia's emissions are just a very small percentage of global emissions, then we really need to start sort of looking at contributing to basically global energy solutions. So I have adopted a particular focus around emerging energy technologies and research into that area, and I guess, in terms of the nuclear side of things that does have a sort of direct implication with nuclear technologies. I guess what I hope to be able to represent a bit to this committee is what is happening in the emerging energy technology sector, and that includes emerging new nuclear technologies but also a number of other technologies that are sort of midway between chemical and nuclear systems, and also subnuclear technologies, which offer energy potential of perhaps around 50 times the energy density of nuclear—so just an incredible amount of energy potentially in some of those technologies.

So, look, in some ways I just hope to be able to sort of answer your questions on some of these technologies, because my view is that in the future, within 10 to 15 years, we will not just be looking at nuclear in terms of energy sources; we will be looking at subnuclear. We will also be looking at superchemical. So potentially we have got two completely new technologies there, and then there is a third one too, which is low-energy nuclear—the idea that we can trigger nuclear reactions under fairly sort of reasonable conditions. We are talking sort of desktop laboratory-type conditions. There is a whole range of new technologies coming into play, so I guess what I am sort of keen for is that with legislation development we should be considering the range of new things coming through in addition to just looking at uranium-based solutions. Thorium definitely is part of the story, but a lot of these new technologies do not necessarily require uranium or thorium to generate large amounts of energy.

So, look, to give you a bit of a background in terms of where some of the technologies are, some of them are already demonstrating 10 times energy out versus energy in. The subnuclear stuff is quite amazing in terms of being able to, from a benchtop, sort of generate energy releases 50 times nuclear fusion, which is probably hundreds of times nuclear fusion in terms of energy potential.

I just really sort of put up the proposal that Victoria should be looking at saying, 'Well, how can we really contribute to global solutions to climate change?'. I think this emerging energy technology sector is a really,

really important sector commercially in terms of climate outcomes. It has got strategic implications as well in terms of national security. I just really think that when we start talking about nuclear policy, we need to be aware of what is coming up in the emerging energy technology sector and make sure that we are giving adequate consideration to those technologies as part of the policy platform.

The CHAIR: Thank you very much. That is excellent. Now we can move to questions. Who would like to go first? Any hands up? Mr Limbrick.

Mr LIMBRICK: Thank you, Chair, and thank you, Mr Brink, for your submission. You have a very interesting angle and a unique submission to this inquiry, so it is quite interesting. I cannot help but ask you, because it is a passion of mine as well—I know that you are interested in telescopes and space—

Mr BRINK: Yes.

Mr LIMBRICK: One of the applications of nuclear technology that we have not talked a lot about is space exploration, and I know that there are a lot of people keen to get the space exploration industry set up in Victoria. Historically we have had some lead on that. Could you maybe indicate some applications of this technology for space exploration, if this is something you are interested in? But I guess you are if you are interested in telescopes.

Mr BRINK: Okay, yes. So, look, there is one technology which is called superchemical reactions, and basically what it is looking at is taking hydrogen to a contracted state of hydrogen, and in that process it releases large amounts of energy. So typically, compared to sort of a normal chemical reaction, the energy density is going to be, say, 20, 30, 40, 50 times the density of an explosive-type reaction. Even with something like a TNT-type explosive reaction you can get 20 to 30 times the energy out just basically using hydrogen and these sort of advanced systems. So there is the potential there for basically rocket propulsion systems that are based on this hydrogen reaction, and so in terms of space exploration there is huge potential because, you know, if you are getting essentially 20, 30, 40 times the energy out of your mass of hydrogen, you can get a lot more stuff up into space and basically space becomes a lot, lot more accessible.

Also the problem with nuclear is you cannot run rocket engines off it really. Nuclear is great in space for the international space station—powering all of your electricals and all that sort of stuff—but it does not necessarily apply to rocket propulsion, whereas these systems definitely apply to rocket propulsion. They are being looked at for things like scramjets—you know, the sort of systems that fly at mach 15 or mach 20 at the moment—in terms of research for these types of systems because there is a large amount of energy density. So that is sort of the military application that is being developed in some other countries at the moment for it, but in terms of civilian, positive things and thinking about going to space, there is definitely huge application for the technology in that area.

Mr LIMBRICK: And you also just mentioned something that is interesting about power sources. What a lot of people do not know, I think, is that pretty much any of our deep-space probes that humanity has sent, they are all powered by nuclear batteries, and this is something that current legislation prevents us having anything to do with in Victoria. Maybe you could outline what these batteries are and what might be the applications for these in the future.

Mr BRINK: I guess the nuclear batteries are fairly well established technology. It may well be that they remain the sort of technology for that sort of battery application in space. I am supportive of the idea that if we are having space-based missions, the idea of using nuclear technologies for batteries in them is really good. These emerging energy technologies have not been yet developed to the stage where they can produce electrical power in a battery-type situation. It is more just net energy coming out as heat. In a ground-based application you could generate the heat and then you could basically connect it is up to a normal power station using thermal energy to generate electricity. But they are probably well behind nuclear batteries in that sort of sense. As I said before, in terms of propulsion stuff, yes, definitely. But in terms of the subnuclear stuff, the energy that is coming out of that, we are talking about 50 times fusion or more than 100 times fusion. So that sort of energy there, if you are going to be sending long-term space missions out the potential energy for those things is a lot, lot more than nuclear to run something. If you want to set up something on another planet or something like that, you have got so much energy there for lasting hundreds and hundreds of years from earth without having to find a power source in space. So there is definite potential in that sense. But look, I am probably willing to say that the existing nuclear battery technology is probably pretty good for most applications in terms of generating power at this point in time. So I am definitely supportive of the idea that we need to at least be looking at nuclear technologies. That is obviously the base proposal of this inquiry, and I am definitely supportive that Victoria needs to allow for some of these nuclear technologies to be released in that sort of area.

Mr LIMBRICK: Thank you, Mr Brink.

The CHAIR: Thank you, both. Who is next? Mr Hayes? Ms Taylor?

Mr HAYES: Nothing from me at this stage, thanks, Chair.

Ms TAYLOR: So noting you said just a couple of things—'Australia contributes a small percentage of global emissions'—what was the inference with that? Why did you want to make that statement?

Mr BRINK: Well, I think for me from the environmental perspective I have always been keen that nuclear power should be part of the energy mix to allow for a transition away from fossil fuels, but there is always the risk in terms of nuclear waste; there is risk in terms of nuclear proliferation. There are a range of risks associated with nuclear. Nuclear does potentially offer a sort of a silver bullet essentially to solve, you know, global climate change issues. Now, if we were to have some safe nuclear technology, the amount of energy there is so much that potentially, you know, we could move away very rapidly from fossil fuels at a global level. And so I guess the real inference—what my main point is—is that what Australia does alone just is not going to influence global climate change outcomes, because we are such a small percentage of emitters.

You can look at the growth in other countries. Now the growth in China in terms of greenhouse gas emissions is more than Victoria's total emissions. So I think realistically we are not going to solve the global climate change problem with anything we do in Victoria unless we engage in the emerging energy technology sector, unless we can actually say, 'We have got a technology here in Victoria that can basically solve the climate change situation globally'. If we can offer it to other countries, it will be a potential negotiating chip. We can say, 'Okay, here's a system. It's a superchemical energy system. It only requires hydrogen. It's very small. It's very compact. We can offer it as a direct substitute for your existing coal-fired power stations. It's suitable also for shipping transportation, that side of things, which no other green technology is suitable for at the moment'. And so potentially we get into a leverage situation that is a great commercial situation, but it is also actually an opportunity for Victoria to potentially really make a very significant difference to global climate futures. And so that has always been my contention.

When I was 20, I said, 'I'm not going to own a car'. I rode my bike around for 10 years until I was 30. But then I came to the realisation that me riding my bike around was not going to save the planet. And so we have got to jump from this sort of thing. Yes, it is good to turn our heaters off and wear jumpers and all that sort of stuff, but realistically, to really influence the planet we need to be there to offer technologies to allow other countries to substitute away from fossil fuels. And that may be nuclear. Good, clean IV-plus generation nuclear may be the solution. There is a lot of good potential there in those systems. But these emerging energy technologies also offer a lot of potential in that space.

I just think we need to start changing our thinking about what we can offer to the international community to get them off fossil fuels, to get everybody going in the same direction, onto these new energy sources by 2050. By 2050 we will probably already be at 3 degrees of climate change, so we have got probably a good 30 years now to really make that transition. The technologies are there in terms of we know what we can do. There needs to be more research in terms of getting them to the commercial stage, but they are there. The technologies are there to get us to that point, but it just needs support. It needs the right systems. It needs people saying, 'We understand this. We understand that this is a potential path to solving the global climate change issue' and setting up systems to allow the commercial sector to be able to run with it.

The issue with the commercial sector is because this stuff is very high risk—with all these technologies, you are never quite sure whether you are going to get it right or you are not going to get it right. I mean, commercially people are very risk averse. They want sort of a 90 per cent chance of success. These technologies might have a 10 per cent chance of success, which in a commercial sense does not really work.

So around the world, in most of the countries that are doing research in this area, it has got a bit of government backing, it is coming out of universities. There are probably about 20 or 30 private businesses that are working in these areas, but they tend to have a bit of university backing and that sort of stuff to help things along. So there are plenty of other countries around that are actively supporting and getting involved with this sort of space. I guess it just needs to be said that Victoria and Australia really do not have an active profile in the emerging energy technology space.

And so going back to the original question around what the importance is of recognising that Victoria's emissions are really small, the importance is around recognising the solutions to climate change need to be global, both technologically and politically.

Ms TAYLOR: Right. The reason I raise that concern is I do not like it when we diminish our relative contribution. You can convey, 'Oh, we only contribute so much', but I get very concerned when people do do that, because it is sort of an attempt to get us off the hook with our contributions to pollution. So that is why I raised concern with that.

My other question was: all these technologies that you have talked about, where are they commercially scaled up in the world and where are they supporting communities?

Mr BRINK: Okay, look, the technologies are very much at research stage, so of the three technologies I will talk about, superchemical is the first. Essentially there is a big company in the US that is focusing specifically on that. They have got a few hundred million dollars of investment going into it. At the moment they are generating about 10 times energy out versus energy in on a continuous basis. It is sort of enough energy to basically run a small car on, but they are at that sort of stage in terms of prototype demonstration. That is really promising. I would expect that they will get momentum. They probably at some point need to get some big investors and move to large-scale manufacturing, but they are not far off that in terms of the technology, which is pretty exciting.

The second technology I will talk about is the low-energy reaction sort of sector. That sector I guess has been active for probably the last 25 years or so. That sector has not been doing so well in terms of energy generation, but they have been doing very well in terms of things like producing new elements, so they are able to controllably produce very rare elements for medical research and that sort of area. So I mean success in a slightly different area.

The third area is a subnuclear sector, which is something that is quite new but it is important because it does offer such a huge amount of energy out. Essentially what we are talking about is annihilation reaction, so basically it is Einstein's $E=MC^2$. So the entire mass of hydrogen is being converted to energy. There are some challenges about, but they have got these reactions, they can demonstrate these reactions. It is more the papers published on it and all that sort of stuff, so it is in the public domain, it has all been very well described. There, there is still more research to do in terms of getting the reaction rates up to a number of reactions and then also converting the energy that comes out. It comes out as certain particles which decay and that has to be then converted into energy. That technology is not as close as the other ones to commercial release—it is probably 15 years away in terms of getting to commercial release. But the key point with some of these sectors is it is about recognising paths to better climate futures.

A lot of these sorts of things, that last one I am talking about, essentially there are three guys who have been researching this. You have got three people essentially with a technology that could save the planet, and people are not getting in there and not getting on board and saying, 'Well, let's help you. Let's try and work these things out'. So my point remains that we need to sort of be saying, 'Okay, what are some of these technologies? What is the potential? What are the opportunities for Victoria? What can we do about sort of saying, "Okay, within 10 or 15 years, can we potentially support some of these technologies to be released to a point where the commercial sector will just run with them and put them out there?"' It will get to the point potentially where fossil fuels are just simply not viable, that these technologies basically offer a direct replacement for some of these fossil fuels.

I guess on your point around what is ready at the moment, no, they are not ready at the moment. No, they are not actually offering communities anything today. They are not helping communities today, but the climate problem is not so much about today; the climate problem is about the next generation. So that is my view, that we need to be thinking about, 'Okay, into the future, where do we need to be in 20 to 30 years time?', and I think these technologies really need to be seen as part of the story.

The CHAIR: Excellent. Who have I got next? Mr Hayes.

Mr HAYES: Thank you very much for your presentation and answering the questions today, Mr Brink. I just wanted to ask you: you did mention the role of renewables, do you think that there is a chance for Victoria to develop and become a world leader in renewables and even the possibility for Victoria and Australia, but more Australia, to become a leader in producing a gas like hydrogen gas from solar and exporting it, or those sorts of technologies? Do you see them as possibly offering a large bang for our buck soon?

Mr BRINK: Okay, so there is a range of different technologies obviously in the renewables sector, so I will cover a few. I think in terms of your traditional wind and solar, I mean, Australia was a leader early on in solar. I think that there is a realisation a bit now that many other countries have sort of gone quite a lot further than where we are now in terms of technology. So in those sectors we are always going to be playing catch-up. The number of industries over in China that are researching next-generation solar is a lot. We can become more active in that space but we are a long way behind. We do not really have any sort of particular points of difference to really push us ahead in that space.

In some ways you have got to congratulate China on the fact that they have put all these solar technologies out there for the world to be able to use. I definitely support the idea that we get more involved with those sectors at a general sort of level, but the commercial reality of it might not be so good. We would have to really look at the commercial reality in terms of 'Can we actually get to a point where we can sort of be leaders in the market and offer something that is going to jump ahead of the competition?'.

The next point was around the hydrogen technologies. The hydrogen stuff is really—I mean, the way hydrogen is being proposed to be used, what you are doing is you are using hydrogen basically as a battery, because you need energy essentially to get water. You separate the hydrogen and oxygen out. It takes a certain amount of energy, and then when you combine the hydrogen and oxygen back together you get the energy back but a little bit less, because you lose some energy in the process. So essentially what the hydrogen technologies that are being talked about at the moment are sort of saying—well, it is like using hydrogen as a battery. So instead of storing a chemical battery you are storing it in hydrogen as a gas compared to water.

So look, I think in my view there is some potential now. You have got to have a look at the whole commercial side of things. I mean, to generate hydrogen in Australia you have got to put it on big ships, you have got to take it a long way to other countries and you have got to release it, but if you go back to what I am talking about here with these new technologies, particularly for instance if you take the subnuclear technology stuff, the amount of energy you are getting out of the hydrogen/water-type reaction is sort of something like a couple of EVs—electron volts. If you actually, instead of doing that, take your hydrogen and you basically do a mass-to-energy reaction, the energy you are getting out of your hydrogen then, for H_2, is around 2 GEVs. A G—a giga—is 10 to the power of nine. So you are talking about 10 to the power of nine times more energy than you are getting out of getting your hydrogen and joining it back to oxygen and creating water. So in terms of energy technologies you have got an absolutely huge divide between the energy out of these two different technologies.

The hydrogen stuff might get up and running and might generate stuff. You have got a big solar farm, you are generating hydrogen gas, you are compressing it down, you are putting it on a big ship and sending it across overseas, but regardless of who does it, if someone comes up with this stuff and they can get to a commercial system that can basically produce 10 to the nine times more energy out of hydrogen versus what we are selling in Australia, you will find overnight it has basically quit and no-one will be interested in buying hydrogen and running it off the systems there and they will switch over to the new technologies. So regardless of what we do in Victoria we need to be aware of where the new technologies are going and what they might potentially be offering.

Mr HAYES: Thanks, Mr Brink.

The CHAIR: Thank you. Have I got any further questions from any of the members? Please raise your hand.

Mr HAYES: Can I ask one more if there is no pressure?

The CHAIR: You definitely can. There is plenty of time. Yes, please, Mr Hayes.

Mr HAYES: Mr Brink, just on those three industries that you are talking about that you thought were goers or potential goers in Victoria, we have heard a lot about nuclear waste this morning. What sort of waste would they produce, and how would you see that being managed in the long term?

Mr BRINK: Okay. So the superchemical reactions do not produce nuclear waste—it is not a nuclear reaction—but they produce a denser form of hydrogen. So basically by contracting hydrogen down to a smaller size you get your energy out like that. I guess the health impacts of the contracted forms of hydrogen have not really been yet fully explored in terms of that there are not sort of public scientific papers identifying what the potential risks of those dense forms of hydrogen are. So it is a bit unknown. I guess what can be said is some forms of contracted hydrogen, when you get it down really, really small it can actually be sort of a catalyst for nuclear reactions, so it can also be used in terms of actually I guess benchtop nuclear reactions using the contracted forms of hydrogen. There is some uncertainty around that, but I mean there are a number of contracted forms of hydrogen. In the superchemical systems you only contract the hydrogen a little bit, but there is also the potential—there are other systems where you have to contract the hydrogen a lot. So at this stage there have probably been, you know, 25 years of research on the contracted hydrogen technology, and there has been no suggestion yet of any adverse health outcomes from the research groups that have been looking into it. So that is one.

The second one is the low-energy nuclear reaction technologies. I guess it depends on what isotopes you are creating. If you take one isotope, you can basically move it up—you can sort of increase the atomic mass of the isotopes and move them up to the next isotope. So if you take one that is just below a highly reactive element and you move it up to the highly reactive radioactive element, then obviously you are creating some nuclear waste in that situation. But interestingly, the low-energy nuclear stuff actually has some really good applications in nuclear waste removal. What has been demonstrated in the last couple of years is you can actually take nuclear waste—uranium, whatever, all your caesium isotopes and all that sort of stuff—and you can put it in these processors and you can basically deactivate the radioactivity of the material. For example, I did some tests a couple of years back. I sent some electrodes off to the CSIRO, and basically it was a desktop sort of set-up—I was using sort of 50 000 amps or something like that—but basically we were able to alter the nuclear make-up of these rods that we were assessing. There are a few researchers around in the States and other places that are using these processes to potentially deactivate rods from nuclear power production. So the low-energy nuclear stuff has such a range of applications, but at this point there are no real particular good energy applications that are coming out, but the application is more in actually nuclear waste remediation, which is really quite exciting.

The third technology, the subnuclear reaction systems. I guess they produce particles which are not neutrons; they are probably typically around about one-eighth of the mass of a neutron. So they are often neutral particles, and they tend to sort of decay into other particles. Neutrons tend to have the ability to basically bind onto other nuclei and basically change their atomic number, which creates the radioactive element. Because these particles are around one-eighth of the mass of a neutron, they do not tend to bind to other particles in the same way. I guess because they can be quite penetrating particles—they can go through things—in some ways there is a need for shielding on these particles. You know, if you were standing too close to something that was emitting a large amount of this stuff, it would probably have the potential for biological disruption, but it is not creating radioactive elements in a long-term sort of scale. In some ways it is more similar to something like gamma radiation where if you are sort of directly exposed to it, there would be health implications, but if you shield it and you make sure that you have got adequate barriers, then you are not generating nuclear waste. So it is a short-term, direct health implication rather than being a long term, chronic, creating waste-type situation.

The CHAIR: Excellent. Is there nothing further? Mr Limbrick.

Mr LIMBRICK: Thank you, Chair. Just one further thing. Back to the point of the inquiry, I suppose: these technologies that you are talking about, many of them are sort of cutting edge. If there is no sort of carve out in our prohibitions, is the main concern that you have that we will be left behind and our research institutions like universities and such will not be able to participate in the development of these technologies? I take your point that you said before—with some of these other big technologies, like solar and stuff, China has pretty much taken the lead on that and we would have to do something pretty revolutionary to stand out from the pack. But there are other opportunities with other technologies I think is what you are saying. Is that sort of right?

Mr BRINK: Yes. The last point, obviously yes. There are other opportunities definitely with other technologies, and I think that is really important to sort of try and look into the future in that sort of sense. But the question on the universities, the fact that we potentially get left behind, yes, that is an issue. At the moment Victorian law is sort of saying 'No nuclear stuff'. It is interesting, because I did an experiment out in the lab and in the garden a couple of years back. We sent the little probes off to the CSIRO for testing and they basically confirmed that we had generated a nuclear reaction, and it was basically not much different to essentially an electrical system that would be used in most transformers in the electrical industry. So I think what has actually been recognised now in particular is nuclear reactions are actually happening all the time. There has been this sort of thing around for many years that to get a nuclear reaction you need to produce a hundred million degrees in a sort of a nuclear bomb bin or you need to have a radioactive isotope, but the reality is that nuclear reactions are happening all the time.

If you actually go back and do the research and look at some of the published papers and that sort of stuff, there is a whole trail of stuff going back to the early 1900s around these reactions. I mean, things like the early photographers when they were doing photography with their mercury-based photographic plates, they used to find specks of gold in them, and that was basically demonstrating that there was a transmutation process going on in their photography. There have been researchers that have looked into transmutation in animals and, as it turns out, in some of the seashells the shells that they produce the chemical elements in the shells are not present in seawater. It is undisputable that there are a whole lot more nuclear reactions going on in normal, everyday life than is recognised by sort of normal, mainstream science. You sort of look at nuclear prohibition and you say, 'Well, is it illegal to be a shellfish in Victoria?'. Then you sort of say, 'Well, how is that also potentially affecting these research institutes and the universities?'.

And, yes, I guess it is probably the same point there. If we do have these three new technologies that are coming up and emerging, if we do have rules in Victoria that are meaning that we cannot proceed with even sort of basic research in these areas, it definitely really creates problems for commercial opportunities in Victoria. I definitely would be supportive of trying to—at least definitely in terms of research sense—move away from any sort of blanket rules on nuclear prohibition. Things need to be controlled and all that sort of stuff, but I guess it is also a matter of: what is the level of control in terms of regulation? If you think an experiment might be creating a nuclear reaction, do you have to go and get a permit for it, and all that sort of stuff. I think is just important to keep a bit of perspective on where the research is and where the possibilities are in some of this stuff in developing legislation.

Mr LIMBRICK: Thanks, Mr Brink.

The CHAIR: Okay. Well, thank you very much for everyone's contribution. Mr Brink, we really appreciate your valuable contribution to the committee. What you have put in today is excellent and your submission as well, so thank you very much. A copy of the transcript will be sent to you, so if you have any changes or there are any omissions, please feel free to amend it and then sent it back. That will be published on our website. Thank you.

Witness withdrew.