

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 Michael Shellenberger, Environmental Progress.

The CHAIR: I declare open the Environment and Planning Committee public hearing for the Inquiry into Nuclear Prohibition. Please ensure that your mobile phones have been switched to silent and that background noise is minimised. I would like to take this opportunity to welcome members of the public who are watching the live broadcast. I also would like to acknowledge my colleagues participating in this inquiry today: Dr Bach; Ms Taylor; Ms Terpstra; Mr Limbrick; Mr Hayes, the Deputy Chair; Mr Meddick; Ms Bath; and Mrs McArthur. I would like to welcome our next witness, Mr Michael Shellenberger from Environmental Progress all the way from the US. Welcome, Mr Shellenberger.

I would like to state that 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 shall give today is protected by law. Any comment made outside this hearing may not be protected, but also it is important to note that protection only applies in relation to Australia and Victoria; it does not extend to your home country. Any deliberately false evidence or misleading of the committee may be considered a contempt of Parliament. All evidence is being recorded. You will be provided with a proof version of the transcript following the hearing. Transcripts will ultimately be made public and posted on the website.

Mr Shellenberger, we have got your submission. We allowed around 5 minutes to do an opening statement, and then, as we have eight members participating and with the restriction of time, we have allowed about 5 minutes for each member's questions and answers. I will try to stick to that. Again, thank you very much for making yourself available. We appreciate it. Please go ahead and give us an overview. As I said, we have read your submission as well.

Mr SHELLENBERGER: Okay. You have read the written testimony I submitted already?

The CHAIR: Yes. So a quick overview would be great.

Mr SHELLENBERGER: Sure. I am happy to encourage Victoria to remove prohibitions enacted by the *Nuclear Activities (Prohibitions) Act 1983* and include nuclear power in your pursuit of clean energy. The United Nations Intergovernmental Panel on Climate Change says we need nuclear to deal with climate change. Right now Victoria gets about 80 per cent of its in-state electricity from fossil fuels—much of which is brown coal—and as you are seeking to retire coal-fired power stations there is a need to keep the electricity prices low.

Two weeks ago the Australian Energy Market Operator published its *2020 Integrated System Plan*. It is admirable that groups are trying to work through their future difficulties, but by excluding nuclear up-front, the study goes against the recommendations about the importance of and the low-carbon nature of nuclear energy. Even more worrying, by excluding nuclear but increasing interconnections the integrated system plan is pointing our way to an unstable grid, ever more reliant on the few remaining fossil fuel facilities. Because the plan is most vague about the worst of the variability and storage problems—that have never been solved, by the way, anywhere in the world—while eliminating the successful majority nuclear solutions that have been demonstrated time and again, the plan is taking major risks with the Australian people's health and welfare.

I will just say that, you know, I am in California, and we tried to do this with renewables, only we have been shutting down our nuclear plants. Our electricity prices increased six times more than they did in the rest of the United States. We now see that in Germany. The expansion of wind power has stalled out. Germany saw its electricity prices increase 50 per cent over the last 10 years. And just compare France and Germany: France gets 75 per cent of its electricity from nuclear, Germany is phasing out nuclear; France spends about half as much for electricity that is 10 times less carbon intensive than German electricity. So renewables were fine when we were countries of small farmers, but as high-energy, industrial people the only serious alternative to fossil fuels is nuclear energy. Thanks for considering my testimony.

The CHAIR: Thank you very much. Now, who was booked up first? Mr Hayes, Deputy Chair.

Mr HAYES: Mr Shellenberger, thank you for your submission. I just want to go to the issue of nuclear waste and how you would envisage what sorts of volumes of nuclear waste per annum we might be looking at if we were to significantly go to nuclear energy production, and how would we manage those volumes of nuclear waste, storing them over the long term? What would you see to be the safest, most practical way of going about that?

Mr SHELLENBERGER: Thank you for the question. What we mostly refer to as the nuclear waste are the used fuel rods, which are usually cooled for about a year and a half or two years in water and then they are stored in what we call dry cask storage. They are just stored inside steel and cement. For me, as an environmentalist, nuclear waste is why nuclear is the best from an environmental point of view. No other form of energy production contains all of its waste. Solar panels go into landfills. Fossil fuel waste goes into the atmosphere as air pollution and as coal waste.

For me, the nuclear waste is best stored at the site of production. So that is the first thing. You want to have the waste stored where it is produced—that would be at the site of the plant. There is hardly any high-level nuclear waste. All of the United States nuclear waste can fit on a single football field stacked 50 feet high. In the Netherlands, I tweeted recently a picture of a building smaller than an aeroplane hangar. They store all of their nuclear waste there, and they also store some of their oldest tapestries from the 16th century, their finest artworks, because it is climate controlled. They have gala art functions next to the used nuclear waste. So, for me, I would say the best thing is to just keep it at the site of production.

We do think that at some point all of that used waste, that used fuel, can be recycled or reprocessed. But for me there is no need for it. I do not agree with the nuclear industry, which thinks that it needs to be stored at a single place. They have never made a good argument for that. It always seemed like a way to make money, pointlessly. The best place to store it is right next to the plant. So, for me, that is what I would recommend. However, if Australia were to work with a different country to build nuclear plants, some countries are offering to take back the used fuel rods. I do not think it is necessary, but certainly it is something the Russians are offering and it is something the Americans might offer. It is something the Koreans might offer as well.

The CHAIR: Thank you. Who will I invite next? Dr Bach.

Dr BACH: Many thanks, Chair. And thanks also, Mr Shellenberger, for a fascinating written case that you have put to us but also your presentation. Can I initially pick up on a fascinating comment that you made just now in response to the Deputy Chair regarding waste? Do I understand your meaning correctly when you say—or when you implied in your remarks just before—that the impact on the environment, speaking as an environmentalist, as you said, of the by-products of the nuclear energy cycle is actually less than the impact on the environment of the waste products of other energy forms?

Mr SHELLENBERGER: Yes, by orders of magnitude. So, we calculated on a unit-by-energy basis how much more waste solar panels produce than nuclear plants, and 200 to 300 times more waste is produced by solar panels than nuclear power plants. It is an astonishing quantity, and the reason for it is that sunlight is dilute, whereas a single glass of uranium as nuclear fuel is enough energy to power my entire life, including all my jet travel. And that is just because the miracle of splitting atoms releases so much energy in the form of heat, whereas sunlight is very dilute so you have to spread, as you are all experiencing in Australia right now, very large areas of land—and that means a lot of materials throughput. So it takes 17 times more materials for solar to generate the same amount of energy as nuclear, and it requires 300 to 400 times more land for those solar panels. And there is no recycling. Sometimes people will say, ‘Well, we will recycle the solar panel’, but it is not worth it for the solar manufacturers to recycle the panels. It is just cheaper to buy the raw materials themselves. So, yes, with nuclear waste at least the used fuel rods are the only waste by-product from energy production that is stored at the site of production, which is what we all learned in our environmental studies classes—and it is correct—is the most ecological kind of waste.

Dr BACH: All right, many thanks. I think I have got just a little bit more time, Chair? I will ask you a follow-up about poverty. I note that that is something you are passionate about and your organisation is passionate about. There are too many Victorians living in poverty. Our economy has really been hit as a result of COVID-19. Of course it is something we are all concerned about here. Would you mind expanding upon the comments you made about the different paths that we may take as we seek also to reduce our carbon emissions? There is bipartisan agreement about the need to do that here in Victoria. Should we seek to go down

a purely renewables route versus the sort of route that potentially we could go down if we lifted the nuclear prohibition? Could you expand upon the impact on poverty and the impact—especially when it comes to fuel prices, as you were saying before—of the different routes?

Mr SHELLENBERGER: Yes, absolutely. So just like making food more expensive is regressive—because, you know, the poor and working-class people spend a higher share of their income on food and energy—making energy more expensive is the most regressive kind of taxation, whether it is a formal tax or just making it more expensive, and that is because everything in the economy requires energy, including services of course. So making energy expensive is one of the most regressive things, and so it hurts the poor and working-class people more than it does middle- and upper-income people.

The record is very clear, and the reasons that unreliable solar and wind make electricity expensive are well understood now. A former Obama administration economist named Michael Greenstone, who recently testified along with me in the US Congress last week, his research shows that the effect of renewables in the states that have done renewables deployment increased the cost of electricity by \$125 billion. All that is available on Google and elsewhere. California, again, had a six times greater increase in electricity prices compared to the rest of the United States, and Germany has seen electricity prices rise 50 per cent. So this is not a coincidence. Of course the paradox is that with solar it seems like it would be cheaper because solar panels themselves have become cheaper over the last decade. So all of those additional costs—the cost of renewables—are externalised onto the rest of the electricity grid.

So it is all of the things you have to do to manage all of those unreliable renewables coming onto the grid, whether it is batteries or hydrogen or pumped storage or just operating your gas turbines to idle to really ramp up, plus all the additional people required to coordinate this. The reason grid electricity is so cheap is because we are constantly matching supply and demand. When those two things become unmatched and you add energy conversions, taking electricity off the grid and bringing it back on, you are significantly adding significant cost to the electricity. So that is the mechanism for it, and we see it everywhere in the world.

Dr BACH: Thank you very much.

The CHAIR: Thank you. Can I go now to Ms Taylor, please.

Ms TAYLOR: Thank you. Thank you, Mr Shellenberger, for your contribution. So in an article, I think it was dated 4 November 2019, you claimed that everything they say about the California wildfires is wrong. The main thrust of the article was to downplay the impact of a warming climate on your home state wildfires. Do you reject the notion that anthropogenic global warming increases fire risk? So that is the first question; now I will now go to the second. In a 2018 article you wrote for *Forbes* magazine you made a strong positive connection between nuclear power and nuclear weapons, noting that Australia was one of 20 nations that had sought nuclear power in part to give itself the option of creating a nuclear weapon. Do you believe that Australia should pursue nuclear power as part of its defence strategy?

Mr SHELLENBERGER: Thank you for the question. On the first question my intention was certainly not to downplay climate change. I have been a climate activist for 20 years. I have been an environmental activist 33 years. Rather, I was growing very concerned about the impact of climate alarmism on adolescents in particular. My daughter is 14 and she is fine because I talk to her about the science, but her friends do not know if they going to live long enough to have kids. So I believe that humans are causing climate change. I think it is a problem we need to address—in fact I spend much of my time addressing it—but it is not the end of the world and it is not even our most serious environmental problem. So I felt the need to push back against that. The article on forest fires, in that article I quote the most—and I had a long interview with them—respected expert on California forest fires. He read the article in advance. He requested no corrections afterwards. In that article I acknowledge that, yes, a warming world is making for a longer fire season, but all of the increase in severity and frequency of California fires can be explained by two factors: the first is the increase of wood fuel—the accumulation of wood fuel in forests, in mountain forests, mostly because people do not like to have all the smoke; and then the second reason is just increased housing near fires. So that explains the increase in fires in California.

On the second issue, the line between hard power and soft power runs between nuclear energy, and so the reason that countries have always wanted to get nuclear energy was both to have nuclear energy, which offers

the environmental qualities that it offers, and to have what is called nuclear latency, which is the possibility of being able to protect yourself with nuclear weapons. Right now Australia benefits from the nuclear umbrella that we Americans provide Australia. Maybe that will last forever; maybe it will not. I certainly as an Australian would want to have some capability in that department. I was in the Philippines recently, and I have been to Taiwan and South Korea. The Chinese do not seem reluctant to take over islands that they think belong to China, and so I think that is the reason that you are seeing Japan and South Korea wanting to have that latency. There is nothing wrong with people wanting to protect their citizens, and the only way to do that against an adversary like China is to have that latency.

So I would say yes, if I were Australian, I would definitely want to have that latency that is provided by having nuclear scientists, nuclear engineers, nuclear power plants and the possibility in case the United States, for example, continues to turn towards nationalism. And sure, Trump might lose in November and we may not have a Republican president, but we have had an alliance for 75 years where the United States provides a nuclear umbrella to many countries around the world. I do not think most Americans know that we are signed up to protect Australia with our nuclear weapons. I do not think most Americans know that we are signed up for that. I am not sure I would rest very easy on that assurance, because I know for us here in California, where we could be hit by North Korean missile, I am not eager to go and fight the fights of Australia or Japan or South Korea or the Philippines. For now it has been working, and maybe that is the way it will go for a while, but certainly if I were Australian, I would want to have what we call nuclear latency.

The CHAIR: Mr Limbrick.

Mr LIMBRICK: Thank you, Chair, and thank you for appearing today, Mr Shellenberger, and for your submission. A couple of questions: firstly, you used to be antinuclear. Could you briefly run the committee through what changed your mind on nuclear and why you became a proponent of nuclear technology? And a second question, which is probably related to that is: we have spoken a lot about the environmental benefits of nuclear in terms of low-carbon energy production, but what are some of the other environmental benefits of nuclear compared to other forms of energy production that we see and some of those problems that might be avoided by using nuclear?

Mr SHELLENBERGER: Sure. Yes, I was raised to be antinuclear. I am a gen Xer. I was born in 1971. In 1983, ABC television showed a movie called *The Day After*, which was about nuclear war. They encouraged parents to make their kids watch it with them. It was terrifying. I had nightmares afterwards, and I did not understand until I was an adult that a nuclear power plant could not explode like a nuclear weapon. I thought they could. I thought there was some connection. And I think on the one hand—in my new book I describe why I think that—in some ways it is psychological displacement, there is a lot of evidence that after it became clear that antinuclear weapons campaigners could not get rid of nuclear weapons they then tried to get rid of nuclear power plants with some vague idea that that would have some impact on nuclear weapons.

And then after the Cold War ended and the fears of nuclear war declined significantly, thanks to the end of the Soviet Union, like many people my concerns turned to climate change. But as soon as you start to analyse which countries have decarbonised their energy supplies, it is clear that the only countries that have done so in a significant way are France and Sweden, and they did so with nuclear power. And at that point what I really had to do was to resolve my anxiety about Chernobyl. I read the World Health Organization report on Chernobyl. I interviewed the lead scientists. What I learned was shocking, which is that somewhere around a total of 200 people will have died from Chernobyl after an 80-year life span. That includes all the cancer deaths. This is World Health Organization science. After I learned that—I already knew that 6 million people die prematurely from air pollution every year—it seemed kind of obvious that nuclear energy was not what we had thought it was and that we had been displacing our fears of nuclear weapons onto nuclear power plants in some romantic idea that if we got rid of nuclear plants we would get rid of nuclear weapons. So that was the big thing for me.

When you change your mind about nuclear—the people that are providing the information often are other people that think that the traditional view that we need to move the waste somewhere or that the waste is this big thing to handle, I realised that that was not really the case either and that really the way we handle the waste now in the United States is the best way to handle it. I started to see what other countries, like the Netherlands, had done. So for me the way to think about this is that there is energy progress. Poor people in developing countries—they go from using wood and dung to using oil and gas and coal and hydro-electric dams. And then over time we transition, as Australia is and as many developed countries are. We are transitioning from coal to

natural gas and then eventually we move to uranium. So that is the progress of moving away from what you might call matter-dense fuels—fuels that require a lot of natural resource to get a little bit of energy out of them. A lump of coal has twice the energy of a lump of wood, but a lump of uranium has a million times more energy than a lump of coal. So that process of moving towards energy-dense fuels is, by definition, better for the environment. Energy density determines environmental impact, so if you are moving towards fuels that have much higher energy densities, you are going to have—so people ask me, ‘Are you in favour of natural gas?’, and I say I am in favour of natural gas when it replaces coal and against natural gas when it replaces uranium.

The CHAIR: Thank you. Ms Terpstra.

Ms TERPSTRA: Thank you, Mr Chair, and thanks, Mr Shellenberger, for your contribution this morning. Just a question around safety: obviously this inquiry has heard information around the accidents that have occurred both in Chernobyl and Fukushima. I am just wondering how we reconcile the significant improvements in safety and accident risk with the reality that if accidents do happen—the effect of nuclear accidents as we know can be catastrophic relative to other forms of energy generation. How can we reconcile those? Because obviously renewables do not carry the same sort of risks. So that is the first question.

The second question is: there has been a bit of a discussion around nuclear energy and the propensity for that to bring down electricity prices, but isn't it true to say that the cost of electricity prices can also be impacted by privatisation and regulatory frameworks and policy? I just want you to clarify that, because it is not just purely a function of introducing nuclear. Around the world when you look at privatisation that also has an increase on cost. So if you could just address those two things, that would be great.

Mr SHELLENBERGER: Sure. The first thing you have to remember about nuclear is that it is such a radical event, and it comes right out of the science. The invention of nuclear fission is happening at the lab level, and the invention of it is so radical—it is not fire, it is not combustion, it is releasing heat through splitting atoms, and I think it is shock to the human species. And then it came about in a war, and so the only country of course that ever had nuclear weapons used on it was Japan.

I think there were two things going on with Fukushima. The first was that 15 000 people had just been killed by a tsunami—drowned, trapped under their cars, killed in all sort of terrible ways—and then the meltdown happened and there was an overreaction to it. I am not saying that there should not have been any evacuation, but they overevacuated the province, many people stayed away far longer than they needed to. I think one of the most important studies, and I cite it in my book, is from the British Medical Journal. They found that even people that stayed in the most so-called contaminated areas, eating the foods that had some amount of radiant particulate matter on them, were still below any dangerous levels of radiation. So I just think that we have come to view radiation as a super-potent toxin. That was even more exaggerated in Japan. You had a double displacement, both I think from the fears of the weapon and from the tsunami itself, so you had this ridiculous overevacuation. Nobody, by the way, has gotten cancer, will get cancer or much less will die from the radiation from Fukushima. So that is the first thing.

By the way, there were multiple failures, mostly having to do with it being an older technology. They failed to raise the seawall at Fukushima, in part because they were worried about scaring the local people by raising the seawall, and then they put the backup generators underground, where they thought they would be protected from earthquakes, and they were subjected to tsunami risk.

I totally share your concern about privatisation. The thing you have to remember about electric utilities is that they are a natural monopoly, by which economists mean that we do not want five electric companies competing to string up copper wire everywhere and build power plants; it is just nuts. So we have agreed to either have state-owned public utilities or privately owned utilities that are heavily regulated so they cannot price gouge. In my view privatisation misunderstood the natural monopoly element of electric utilities. At the end of the day utilities serve everybody like government agencies, and so the kind of fuel that you use is going to be dependent on what the people of Victoria and the people of Australia want to use.

In terms of what it means for nuclear, let me say something quickly about nuclear economics. The cheapest nuclear, and this has been true for 60, 70 years, is the nuclear we have the most experience building. They tend to be larger reactors, and it is just the plain Jane water-cooled reactors that we use everywhere. I know there are nuclear advocates and some nuclear industry people that want to sell nuclear that has never been tried before.

As an independent person—I do not take money from the nuclear industry; I do not take money from anybody—I will just say that the evidence is overwhelming that the cheapest nuclear is the large reactors that are cooled by water and that are built by experienced crews. Britain, by the way, is in parallel development to Australia—they are further ahead. They are looking to build new nuclear plants with financing from pension funds, which offers very low risk, low interest capital.

So it seems to me if your question is ‘How would you finance a nuclear power plant like that?’ you would do so either with public money or with very low interest private capital such as from pension funds or other low-risk investors, and what they would need to know to know that it is a good investment is (a) that there is proper political support from the people who have to pay for it and (b) that you are hiring a crew that has had experience building those reactors before in the past.

Ms TERPSTRA: Okay, thank you.

The CHAIR: Who is next?

Mrs McARTHUR: I am happy to go next.

The CHAIR: Mrs McArthur.

Mrs McARTHUR: Thank you, Chair, and thank you, Mr Shellenberger, for your presentation. There is another aspect to environmental degradation from the power industry associated with making sure that we have got capacity in the grid and that is—which we are confronting in my electorate—huge transmission lines traversing the countryside to connect new power sources to the grid. If we were to go down the nuclear path, and given that we have just isolated out 25 per cent of baseload power in Victoria by shutting down a coal-fired power station—which may have been passed its use-by date, we agree—is it feasible then to have nuclear plants, which would create continual baseload power, situated where we have the existing power infrastructure in a coal-fired power station area and therefore not have to build these massive constructions traversing the countryside? There are obviously going to be a lot more of them, and there does seem to be reluctance to put them underground for some reason. Is that an issue we should be pursuing, as we approach the potential use of nuclear power, as an environmental benefit—if you would like to answer that question, sir?

Mr SHELLENBERGER: Sure. Thank you for the question. I am sorry, I forgot to mention that added transmission lines are one of the major reasons why unreliable renewables make electricity more expensive. I am sorry I left that out. It is really land, additional transmission and unreliability. Of course when I say you need 300 times more land to generate the same amount of electricity from a solar farm as you do from a nuclear plant, that never occurs with a single solar farm—it would be too massive. Our biggest solar farm in California produces one-eighteenth of the power of our last nuclear plant, so you would need 18 of these huge farms to produce the same amount of power as a single nuclear plant. That means 18 times more transmission from very distant places. As an environmentalist, the goal, remember, of environmentalism is, or should be, to leave more of the earth to non-human species and habitats, so you are trying to shrink the human footprint. What renewables require is a massive expansion of the human footprint, both directly through the land required for generating electricity from solar and wind but also through the transmission lines.

I do not know enough about the situation—if I knew where the plants were, I could say. But there are obviously safety regulations. Generally, people like to build nuclear plants a bit outside of cities—sometimes as far away as 10 or 20 miles. But the point is that you would only need one set of transmission lines rather than 18 times as many transmission lines—or whatever the number would be—to get the equivalent amount of electricity from renewables.

Mrs McARTHUR: Yes. So if you built them in existing areas where the power infrastructure is, where coal-fired power stations are or are being phased out, that is where the grid is being connected to. The second question is on a sort of hypocrisy on the part of some people who think that it is okay to export coal, uranium and gas but it is not okay for these products to be used to reduce the level of poverty in our country, for example, by reducing power energy prices. We will happily sell it to the rest of the world so that others can have cheaper power prices. But we have got this ideological objection to nuclear power. I mean, I put on the record I am technology agnostic. I think there should be a mix of probably everything so that we increase the supply in the most efficient and effective way, but we have this situation where we happily export these

products, and they bring great benefits to us in export revenue, but yet we are not prepared to use them for the benefit of our own citizens.

Mr SHELLENBERGER: Yes, I hear what you are saying. I will tell you the way I tend to think about it. Sometimes when I testify, members of our Congress ask me, 'Isn't China the real problem?' or, 'Isn't India the real problem?'. The way I think about it is that we should all be trying to move up the energy ladder. We should all be trying to move away from—we should try to be moving towards energy-dense power sources. So the way I think about it is if you can move from coal to natural gas, that is great. If you can go right from coal to uranium, even better, but that is the direction of travel that we want to go in. I do not begrudge Indians who burn wood and dung as their primary source of energy burning coal, but if I were Australian or American or Californian, we have got the technological know-how and the abundant natural gas to be able to use natural gas, so for me that is the way I tend to think of it.

It is harder for poor and developing countries that do not have a developed scientific and technical engineering class to just go right to nuclear power, for example. Every step along the way—building a dam, coal plant, oil and gas, uranium, every step along that way—requires greater technical proficiency, so I think to the question of some of the other benefits of nuclear is that with nuclear power plants it is the most high skilled, high paid. Nuclear power plant workers make more money than any other energy sector workers. Contrast that to solar and wind farm workers; they are just installing solar panels that they bought from China. It is not good work. It is not permanent work, whereas these nuclear plants—some nuclear plants, by the way, they can run now for 80 years. Some of these nuclear plants have had three generations of the people in the same family with high wages. These are sophisticated jobs, so even the so-called blue-collar jobs require a level of sophistication that is not there, for example, for working at a coal plant. So for me that is how I tend to think about it, as moving in that direction.

The CHAIR: Thank you. Can I now ask Ms Bath, and Mr Meddick you are next if you have got any questions after Ms Bath.

Ms BATH: Thank you very much. Thank you for your presentation. It is quite illuminating. In relation to the environmental movement, I feel like you were a bit of a square peg in a round hole because you cannot be placed in a particular position and you have had a movement through your own personal journey. If I was to go out into the street in Gippsland, which is my electorate, or into wherever in Australia and do a straw poll, I would think that there would be still a great deal of people saying there is no social licence for this at the moment. I am interested—and it is a funny word or term, because I think it has a sting in the tail, but I am interested in—how you see, if you were in charge of changing the social licence of the opinions of Australians, what you would do, and how has that worked or not worked in America?

Mr SHELLENBERGER: Thank you very much for the question. I would say I am a 1964 conservationist, in that in 1964—in 1966 the conservationists with the Sierra Club in California were the big advocates for nuclear energy. They understood back then that nuclear energy was the only serious replacement for fossil fuels that had the smallest footprint, and they were not afraid of it. This was before the ascendance of baby boomer, New Left antinuclear movement. I think you are right. Look, if the people of Australia do not want nuclear power, there is not going to be nuclear power in Australia, you know what I mean?

But I do think it depends on both rational and irrational factors. I changed my mind in part because a very famous American conservationist from the 1960s, a man named Stewart Brand, who started the *Whole Earth Catalog*, he changed his mind and I thought, 'Well, if he changed his mind, then I'd better take a second look', and that is when I decided to read the World Health Organization reports. This conversation that you all are having right now is so important. I am just delighted first of all and grateful that you all are even having the conversation.

You asked me what my attitude about climate change is and nuclear. And I say the world will get as hot as we do not have nuclear, because I do not think solar and wind can replace fossil fuels in any significant amount, and natural gas is replacing coal on some trajectories. So if we do not want the world to get very hot, we will do more nuclear power. I think the blunt story is kind of like if we do not want a really hot world, then we are going to have to do more nuclear power, and that may take five years, 10 years, 20 years to overcome I think the psychological hang-up and the psychological fears. But you are absolutely right. I guess one final point is,

and this is another area where I just disagree with traditional nuclear advocates in the nuclear industry, I think the question that—

I am sorry, what is the honorific I should use for all of you? I want to say ‘Mr’ and ‘Ms’, but that is not appropriate. Do I say ‘member of Parliament’?

Ms BATH: MPs, yes. Parliamentarians.

Mr SHELLENBERGER: Yes. I think of the question from MP Taylor about the weapons—I talk about it because I think that what is underlying people’s fears is fears of nuclear weapons. It is this book *On the Beach*. That was a huge book in Australia, right? And I think if you do not talk about it, then it operates on our unconscious, and we know from psychology that when we do not make our fears conscious, they can control us. So for me, I think it is worth talking about.

Nuclear energy can be used to make a very big bomb. It can also be used to heat water to drive a turbine. We do not want the nuclear bombs to ever be used. But the reality is that they are here, and I think there is no chance—in fact there has not been, by the way, since 1945; there has never been a chance—that we would get rid of nuclear energy. So then the question is: what do we do with this incredible power we have? And the nuclear energy industry has always been quick to say, ‘Oh, these two things have nothing to do with each other’. But that is silly, because obviously if you know how to split atoms, you can do different things with them.

So for me, I think it is better to just be straightforward with it. One of the reasons that you want nuclear power is that it is a cheap, environmentally superior alternative to fossil fuels. The other reason is that, yes, countries should know how to use this technology just in case they ever need to protect themselves. God forbid Australia would actually need to do that. Hopefully America will always be Australia’s friend, but maybe not. You know, the world changes pretty radically sometimes, so it is good to have that capability. I just think it is better to have the honest conversation and address people’s fears, which are understandable fears. I think the more you kind of can talk about it, I think we kind of see that there is a better and a worse way to deal with these technologies than to just try to put the genie back in the bottle, so to speak.

Ms BATH: I would just like to take you to task or make you elaborate on one of your earlier comments, because I think when we hear from very much the environmentalist/health-concerned people, they might like this question answered. You mentioned before that as a result of Fukushima there have been no cancers occurring from that explosion. I do not think I am misquoting you; I think I wrote it down. So could you elaborate on why you can say that with confidence, please?

Mr SHELLENBERGER: Sure. I say this with confidence because I have looked at it for so long and I have written so extensively on it. The World Health Organization—you can read their reports—do an okay job of explaining it, but I have spent a lot of time with a particular expert named Geraldine Thomas, who is at Imperial College London. She runs the Chernobyl Tissue Bank. Her mother died of leukaemia. She has no connection to the nuclear industry. She is this independent academic. She is like the world’s expert on radiation and health, and she is a very good explainer. So she has walked me through this.

The other thing I will say is I am from Colorado. Colorado has very high levels of background radiation. It has higher background radiation than most of Fukushima does at this point, and yet we do not have higher rates of cancer. I am going to get a little technical, but the older way we would try to account for radiation’s impact on health is something called the ‘linear no-threshold’, which meant that any amount of radiation—this was the traditional view—was harmful. But obviously that is not true, because people live in high-radiation places and we see no impact on cancer rates. In fact in my home state of Colorado we live longer and have less cancer. That is probably because we are very active. Nonetheless, that has been debunked. The bottom line is it just takes a lot more radiation to cause harm than people thought, and for me that has what has been most remarkable about it.

You know, the 6 million premature deaths per year from air pollution—a disproportionate number of them are from burning wood and dung. And so I think about it this way: when you are burning wood and dung and you are a small farmer and you are breathing that smoke, you are breathing tremendous amounts of particulate matter. And then you get to rich countries—particularly like the Chinese, although it is getting better there, or parts of the developed world—you are breathing less particulate matter and so the consequences are less.

When you get to nuclear and the small amounts of particulate matter that end up escaping during an accident, there is just so little of it. Like I mentioned, just a little glass of uranium is all the uranium you need. So for me, the way I think about it is that you do not want to expose your lungs and your body to large amounts of particulate matter over time, whether it is radiant or not radiant. And in fact the smoke from burning wood and dung is incredibly toxic. For me, it was understanding energy density that actually explains the health impacts as well as the environmental impacts. You want to use energy-dense fuels because they either create zero during normal operations or very little particulate matter during the worst accidents.

The CHAIR: Thank you. Can I ask Ms Taylor.

Ms TAYLOR: Mr Shellenberger, I was just wondering who funds you and the activities that you undertake.

Mr SHELLENBERGER: Well, thank you, MP Taylor, for asking that question. I am happy to say I have always been financially independent, and we have listed our donors on our website under the 'About' page for the entire time at my existing organisation and also at my previous organisation. My donors include Frank Batten. His father founded the Weather Channel, and he is a major high-tech investor, no interest at all in energy, just cares about the natural environment. I am supported by a man named Bill Budinger, who invented the atomically perfect surface to the microchip, also just concerned about the environment and as an engineer is not afraid of nuclear power. Steve Kirsch is another high-tech investor. All the other donors are listed on the website. We are a small organisation. Our budget is under \$750 000.

I will note, by the way, Greenpeace does not list its donors and just a couple of weeks ago announced an alliance with BP. And so in my new book, *Apocalypse Never*, but also in my Forbes columns I have documented the very close, direct relationship between natural gas promoters and many of the big environmental groups. I have not done that analysis for Australia, but I would not be surprised if there is support for it. I did dig into some of the Australian history over the weekend, and I discovered that Australian coal miners were one of the big active forces against using uranium for nuclear. I hope that is no longer the case, but it certainly was back, I think, back in the 1960s.

The CHAIR: It is called self-interest. Thank you very much. Mr Limbrick.

Mr LIMBRICK: One other question, Mr Shellenberger, that we have not covered but is something that this committee is very interested in is about species and the impact on the natural environment both through land usage of power sources but also destruction of native species. Extinctions are a big issue in Victoria and Australia as a whole. I know that you have written on this and spoken about it many times, about comparing nuclear power to, say, wind turbines and their impact on native species. Could you provide a bit of insight and commentary on that, please?

Mr SHELLENBERGER: Sure. Again, on the issue of energy density, the big land use impacts of solar and industrial wind farms is where they have their large impact. Again, somewhere between 300 and 400 times more land is required to generate the same amount of electricity from solar and wind. By the way, this is very easy to calculate now. You can go to Google Maps and right click and draw around a power plant and then of course divide that into the amount of electricity it produces to come up with what is called the power density calculation.

By the way, Vaclav Smil, who is one of the world's most respected energy thinkers and whose books Bill Gates said he looks forward to more than any other thinker, wrote a whole book called *Power Density* where he calculates that if we were to go to 100 per cent renewables for our energy, the land footprint of energy would have to increase from half a per cent, which is what it is on average in developed countries like Australia and the United States, to between 25 per cent and 50 per cent. That is Vaclav Smil's calculation, not mine, but those two orders of magnitude fit with the idea that you would need 300 to 400 times more land. Now, some people have objected, and they say, 'But Michael, the base of the wind turbine is just you know, whatever, a base'. But that misses the fact that what you are putting into the airshed are spinning blades that have a huge impact on birds, bats and insects.

A major report came out from one of the top technical think tanks in Germany last year that suggested that a significant portion of the insect die-off they have experienced in Germany was due to wind turbines. A couple of times a year they have to take the wind turbine blades down and clean them because so much insect biomass accumulates that the blades no longer turn efficiently. In 2017 we saw the top group of scientists of bats warn

that the hoary bat, which is a migratory bat species, would go extinct if wind energy continued to expand. In the United States we have seen bald eagles, condors and whooping cranes all threatened both by industrial wind turbines and by more transmission lines. In Australia, I believe in Tasmania, there is a bird called the Tasmanian—there is a particular species. There is a famous Australian conservationist—I think he is in southern Australia—who warned against the expansion of the wind industry. I am sorry I cannot remember his name, but he got into a big controversy, like me, for criticising the industrial wind—

Mr LIMBRICK: I think it was Bob Brown, possibly.

Mr SHELLENBERGER: What was that?

Mr LIMBRICK: It was possibly Bob Brown, I think.

Mr SHELLENBERGER: Yes, I think it is Bob Brown. He warned against this, and he named particular species. People kind of go, ‘Oh, the birds will fly around the wind turbines’, but birds—I mean they are not humans. They are not reflective animals, they are instinctual animals, and so we see these wind turbines having very significant impacts.

Part of the problem is that at least in the United States they are basically completely unregulated. When birds or bats are killed and fall to the ground they are very quickly eaten by scavengers, so it is very hard to track the numbers, and when they are in the water obviously they sink to the bottom. But the numbers that we have are very significant. Now, the wind industry says, ‘Oh, house cats kill more birds than wind turbines’. Well, that is true, but house cats kill robins and jays and sparrows and starlings. Frankly, they kill the invasive birds that we do not need more of. In fact house cats kill birds that prey on the big, slow-to-reproduce, high-conservation value birds—the hawks, the eagles, the ospreys.

For me as a conservationist, the first goal is to shrink the human footprint, and what renewables require is a massive expansion of it. And what you get with industrial wind turbines is sort of the worst of both worlds because you get these spinning blades that end up directly killing insects, birds and bats in those airsheds.

The CHAIR: Thank you. Was it the orange-bellied parrot they were talking about? I think that is the one. Are there any further questions from any of the members?

Mrs McARTHUR: Yes.

The CHAIR: Mrs McArthur, one last question, and we will adjourn.

Mrs McARTHUR: Would you just like to comment on the fact that we mostly see the advocates for wind towers coming from inner-urban areas, who I am not sure would be happy with a wind tower in their backyard, on their foreshore, in a main street but do advocate for those outside what I often describe here in Victoria as ‘the tram tracks of Melbourne’? Are those advocating for wind tower technology specifically largely coming from an inner-urban area, not a particularly rural area?

Mr SHELLENBERGER: Thank you. Absolutely. When I was a renewable energy advocate the reason I had second thoughts about renewables was because we kept encountering opposition to big industrial wind farms from conservationists. We advocated for a project off the coast of Cape Cod, which is off Massachusetts in the United States—a very affluent community. It is near where the Obamas have a summer home. And the affluent people, the communities, they just stopped the wind farm. I mean, the wind farm developers had spent an astonishing sum of money on it—tens of millions of dollars—and they still could not get it through. Similarly here in northern California, where we are extremely green, it is very left, Democratic party, they have been stopping wind turbine farms from going up all over California in the most environmentally sensitive places. So in fact I discovered in the research for my book there is something that the wind industry calls the Starbucks rule—I do not know if you have Starbucks in Australia; you have it, right? The Starbucks rule is: never try to build wind turbines 50 miles from a Starbucks because it means the community is too affluent and will resist. So what we find is an environmental justice issue: affluent, urban, blue city, blue state, left-wing constituencies want to impose industrial wind farms on communities in our heartland states, in the Midwest, that we would never accept, that we resist. People do not want them.

By the way, they are very loud. Nobody knows this, but they get bent right away, the wind turbines, and they make this screeching sound. The vast majority of people do not want to live near them. So I sometimes joke that people that want wind energy are the most alienated from the natural environment. They do not actually think that wind is the habitat for birds, bats and insects—it is. They do not think about what it is like to live next to these big industrial machines until they are proposed for their communities, and then they get shut down right away. That is the reason, by the way, that in Germany the expansion of wind energy has basically ground to a halt and why it halted in California a decade ago and is now experiencing serious problems throughout the rest of the United States.

The CHAIR: Thank you everyone. Thank you, Mr Shellenberger, for your contribution. We really appreciate you giving us your time today. It has been very valuable. A copy of the transcript will be emailed to you shortly.

Witness withdrew.