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

WITNESSES

Mr Thomas Mundy, Chief Commercial Officer, and

Ms Cheryl Collins, Director of Sales, NuScale Power.

The CHAIR: I declare open the Environment and Planning Committee public hearing for the Inquiry into Nuclear Prohibition. Please ensure that mobile phones have been switched to silent and that background noise is minimised.

I would like to welcome any members of the public who are watching via live broadcast. I would like to introduce the committee members first, Mr Mundy. We have Mr Hayes, the Deputy Chair; Dr Bach; Ms Taylor; Ms Terpstra; Mr Limbrick; Mr Meddick; and Mrs McArthur. They are members of the committee—welcome.

I would like to remind us that all evidence taken at this hearing is protected by parliamentary privilege as provided by the parliamentary *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 Australian law. However, any comment repeated outside the hearing may not be protected. Now, can I just say in particular to you, Mr Mundy, that protection only goes to Victoria. You should note that protection related to any action that could be taken against you in Victoria for your comments here today; however, you may not be protected in a similar way in your jurisdictions. 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 proof version of the transcript following the hearing. Transcripts will ultimately be made public and posted on the committee's website. Now, as a process what we do [Zoom dropout]—

Mr MEDDICK: Excuse me, Chair. You have been buffering there a bit, and we lost you for a moment.

The CHAIR: Okay. That is the internet for you. Mr Mundy, we have got 5 to 10 minutes for you to give us an opening statement—we do have your submission—and then we will go to questions. Members of the committee will be asking you various questions. We have allowed approximately an hour for this session. Mr Mundy, over to you, and again, thank you very much for your time.

Mr MUNDY: It is my pleasure. Thank you. Good morning, my name is Thomas Mundy. I am honoured to be invited to appear before the Environment and Planning Committee of the Victorian Parliament. I have 38 years experience in the power generation industry and have been with NuScale Power—or NuScale as I will refer to them—since 2012. I presently serve as the Chief Commercial Officer, and in that role I oversee among other things our global business development activities.

NuScale is best described as a nuclear technology development company specialising in the development of a 720 megawatt gross nuclear power plant based on NuScale's small modular reactor, or SMR, technology. We are a leading SMR technology developer in terms of overall program maturity. That is, we are not in the early stages of conceptual design development but rather preparing our program for commercialisation involving the manufacture of equipment and the construction of our first commercial power plant—that will be located in the United States—with those activities commencing in just a couple of years. We aim to be the new nuclear technology of choice for the nuclear generation industry in the US and internationally.

I understand that nuclear power generation is presently prohibited by legislation in Australia. My overall contention is that should the legislative prohibitions be removed, NuScale's SMR can provide safe, reliable base load electricity production that can be an integral part of the electric power supply system. The NuScale SMR technology can also be operated as a dispatchable load-following source of electricity to complement and support power systems that have a high dependence on intermittent electricity generation. And lastly, NuScale's SMR is ideally suited to provide process heat for a variety of industrial applications, including district heating, desalinisation, hydrogen production and refinery operations, to name a few.

As you mentioned, I previously provided my written submission to the committee and a presentation, and I will briefly take a few minutes to go through that presentation and highlight a few points for the committee before taking questions. If I am unable to answer any questions from the committee from my own knowledge, I will be happy to take such questions on notice with a view of making a supplemental submission afterwards to answer those questions. So thank you. I think I am able to share my screen and present my PowerPoint presentation if that is okay with the Chair.

Visual presentation.

Mr MUNDY: Before I get started I would like to acknowledge the support of the US Department of Energy—in fact I am obliged to do so; we are the proud recipient of cost-shared financial assistance awards from the US Department of Energy—and I want to point out that any comments I make today are my own and not that of the department.

The CHAIR: Sorry to interrupt you, Mr Mundy. I just want to welcome Ms Collins. I believe she has joined us as well. When I said that earlier, before you put up the slide, I realised I was muted. So Ms Collins, as the director of sales of NuScale, welcome to the hearing. Please go ahead, Mr Mundy.

Mr MUNDY: Thank you, and yes, Ms Collins is a member of the business development team at NuScale. Thank you. NuScale's mission is to provide scalable advanced nuclear technology for the production of electricity, heat and clean water to improve the quality of life for people around the world, and we achieve that mission by presenting what we view as a smarter, cleaner, safer and cost-competitive power generation solution.

With respect to who we are and where the technology originated, the technology has really been in development for 20 years now, and it started with our chief technology officer when he was on the faculty and the head of nuclear engineering department at Oregon State University. Subsequently he commercialised the technology, forming NuScale, and we have been in operation since 2007. We have really grown into a mature organisation, with over 400 employees and six offices in the US and one in the UK, amassing quite a patent portfolio associated with our technology and investing almost a billion dollars to date in the development of the technology both in the testing, the licensing and the work needed to be ready for commercialisation.

Slide 5 shows what is the heart of the NuScale small modular reactor technology, and it is what we call the NuScale Power Module. That is an integral package that is comprised of the inner vessel, being what we would call the reactor vessel, and it houses the reactor core, the steam generators and a pressuriser all in one single vessel. That vessel is then surrounded by its own separate high-pressure steel containment vessel. It also has ancillary systems associated with it, such as decay heat removal and emergency core cooling all in one fully factory-fabricated package. This package, and it is what is at the heart of small modular reactor technology, takes advantage of the economics and the technical benefits of simplification—because it is a very simple design in comparison to, say, current large pressurised water, light-water technology system designs—and also takes advantage of the benefits of repetitive factory fabrication.

There is no field fabrication, erection, or construction of any kind of this module. And the module produces 200 megawatts thermal of heat energy. And when you connect that thermal heat energy in the form of superheated steam to its own power conversion system, which is also a factory-fabricated skid-mounted system comprised of a steam turbine generator and a condenser and other ancillary equipment, it produces 60 megawatts of electricity. The facility itself can house up to 12 of these modules, therefore the total facility output can be as high as 720 megawatts gross.

This I think is probably the most telling graphic in the entire slide deck, and that is the comparison of the NuScale Power Module on the left and everything that is embodied within that module, essentially what we would call the nuclear steam supply system and containment, in comparison to the same types of things that you would find in a large pressurised water reactor power plant of today.

Our module is roughly the same size as the blue component on the right in a typical large PWR, which is their steam generator. The reactor vessel is that dark reddish component, the green components are the reactor coolant pumps and there is also a pressuriser—it is difficult to see—in the back left. All of that is placed in and surrounded by a concrete-steel containment building. And then surrounding that building are additional structures that house additional equipment, components, piping and whatnot to support and service that equipment that is inside the reactor building, including emergency core cooling—it could be low-pressure coolant injection, high-pressure coolant injection—and a number of other systems. We have eliminated many of those. As I mentioned, we do have an emergency core cooling system and decay heat removal, but they are very simplified and they are all contained in the NuScale Power Module, greatly simplifying construction, operation and maintenance of the facility.

In terms of safety, the NuScale technology is really second to none in comparison to existing light-water nuclear technologies. This slide points out one of the many advanced safety features of the technology and what we would refer to as an indefinite coping period. And just to put that into perspective in comparison to the events in Japan with the Fukushima Daiichi tsunami that resulted in those plants being damaged, that was a situation where the station lost all power to support the operation of equipment. The earthquake caused the reactors at those plans to shut down automatically like they were supposed to. The facilities went on backup emergency power, provided by emergency diesel generators, but unfortunately the tsunami caused those diesel generators and those power supplies to be lost. So the scenario is when a station loses power, how long can the station cope with that situation before it needs to do something—before operators need to take action such as opening valves, starting equipment, injecting water, those kinds of things—to ensure that the reactor core remains cool? Unfortunately, with the loss of diesel generators and eventual draining of the batteries at those Fukushima plants, they had about 72 hours to restore power before the overheating of those reactor cores would take place, and in fact that is what happened.

In the case of the NuScale technology, in the event that the facility shuts down as a result of loss of power—and all reactor modules will shut down automatically when power is lost—they will sit there in a safe state and self-cool for an indefinite period of time without the need to add water or any operator action or for the restoration of AC or DC power. That is a capability and feature that is first for the NuScale technology, what we would call an indefinite coping period. New advanced technologies have extended that 72-hour coping period—what the Japanese plants had—to seven days and in some cases even as much as 14 days, but in our case, it is an indefinite period of time.

This graphic just shows the modules being produced in the factory. There have been sized to be able to ship to the power plant site for essentially refuelling and installation. You hook up a steam feed and power to these modules after you fuel them and they are ready for operation. There is no, as I mentioned, field construction, fabrication or erection of any kind required for these modules.

You will also notice, and if you recall in slide 5, that a large nuclear power plant is a fairly complicated structure and building to construct. And in comparison to the reactor building that is shown in the middle of this slide, where these power modules reside, the NuScale power plant is fairly a simpler, straightforward structure to construct. It is certainly much less complicated than you would find in the current large pressurised water reactor power plants.

Our technology is certainly set up to provide highly reliable base load electricity production, but as I mentioned, we can also very conveniently provide process heat by directing that steam from any one of the modules to a variety of process heat applications that we have studied and examined and published papers on. We can also extensively load follow, meaning we can change the output of the power plant at fairly rapid manoeuvring rates to be able to help match load on the system as the output from intermittent forms of generation changes. So as the wind stops blowing or as the sun sets, our technology can complement those forms of generation to support the system demands for electricity.

The technology also has an incredible level of plant resiliency in comparison to those that are currently available, providing features and capability not found in any current plants. We can run in island mode of operation, using the power from the facility itself to run the facility while the facility might be disconnected from the main transmission system grid or when the transmission system grid is lost. That is something that nuclear plants cannot do currently. Therefore we can run in what is referred to as island mode. We can also provide first responder power to help restore the grid when the grid returns to service. The buildings have been designed to be highly resilient in natural events—seismic events, weather events et cetera. The building is resilient and resistant to aircraft impacts. The electrical design of the safety systems are cybersecurity resilient, and also the technology is resilient to electromagnetic pulses and geomagnetic disturbance-type events as well.

We are the first advanced nuclear technology of the SMR variety to undergo licensing in the United States, having submitted a design certification application in early 2017, and we are almost finished with that review process. We expect to receive the NRC's approval of our design by the issuance of its final safety evaluation report in just a few weeks, in early September. We show some statistics there about what it took to get that application prepared and the extent of that application. In addition to the 12 000 pages embodied in the application itself, we probably made available an additional 2 million or more pages of information to the NRC in the course of their review of our technology.

In addition to safety, which is always important to our customers, cost is also a point of consideration when considering whether to purchase our power plants. What I present here is our overnight capital cost for a NuScale power plant should it be deployed at a generic greenfield site located in the south-eastern US portion of our country. It would be a 12-module plant. It is on an overnight capital basis, but you are looking at essentially, for a first-of-a-kind plant, roughly $3 billion or $4300 per kW, or for an nth-of-a-kind plant roughly $2.5 billion or around $3600 per kilowatt. These are based on the very rigorous bottom-up cost estimate that was done and are reflective of the design maturity of our program. I provide the information in the lower portion of the slide there. For example, the estimate is based on 14 000 line items pricing either catalogue quotes, vendor quotes or proprietary cost data for equipment and materials et cetera. So it is a very rigorous cost assessment conforming to AACE International's level for a cost estimate. The modules actually have a better estimate and more certainty around them based upon a level-3 class estimate.

Lastly, as I mentioned, we are preparing for our first project. Our technology has been purchased by a municipal power company in the western part of the US. They are located in the state of Utah but intend to deploy this 12-module plant in the state of Idaho actually on property owned by the Department of Energy at their Idaho National Lab site. As you might expect, in preparing for that project, our program focus at the moment is on supply chain developments, finalising the design and detailed program plans and commercial agreements, because as I mentioned, those activities, in terms of the commencement of manufacture, site mobilisation and other activities, are just under two years away for that project. And with that I am happy to take your questions.

The CHAIR: Thank you, Mr Mundy. Okay, who have I got first? Who would like to go first? Mr Hayes, Deputy Chair?

Mr HAYES: Thank you very much, Mr Mundy. That was a very interesting presentation. It is very interesting technology too. I just wondered: that SMR, has it been approved for deployment or use yet in the USA?

Mr MUNDY: The technology itself in a generic sense will be approved by the NRC next month. We expect to receive the final approval. That approves the technology in a more generic sense. Our customer is preparing and will be submitting what is called a combined licence application—it is actually a combined construction and operation licence. What they will do on that application is they will seek the NRC's approval to deploy our technology at that site. They merely reference our technology in that application because the technology has already been approved, but they have to demonstrate that the site that they have selected is suitable for the placement of our technology, which we already know will be the case. And then in that application they present other information that demonstrates to the NRC that they are capable of owning and operating a nuclear facility and have to address some other information specific to the site, including environmental impacts, emergency planning considerations and the like.

Mr HAYES: So it is site-specific sort of stuff.

Mr MUNDY: Exactly.

Mr HAYES: Thanks, Mr Mundy. My other question goes to the cost. It is generally claimed that this type of reactor is more expensive than larger scale nuclear reactors and even more so than non-nuclear energy sources. How do you respond to that?

Mr MUNDY: Certainly our technology on a dollar-per-kilowatt basis is less expensive than most gigawatt-sized deployments around the world. There are some places in the world through repetitive construction and lower cost labour and sourcing where that number is less, is lower—China, for example, where they are making multiple units of the same kind using a different workforce—but in comparison to the more recent new builds that are going on even in the south-eastern US with some advanced technologies our technology is clearly more economically competitive than those technologies. We are looking at overnight capital costs of $7000, $8000, $9000 per kilowatt in comparison to our technology.

There is no question that there are other technologies on an overnight capital cost basis that do not cost as much as a NuScale power plant, but in the context of the customer's needs and their desire to possibly diversify their portfolio, the need for low carbon generation and an assortment of other considerations we are very competitive generally with combined cycle gas and coal on an overnight capital cost basis and on a levellised cost of energy basis.

Mr HAYES: Thank you very much. That is all for me at the moment.

The CHAIR: Thank you, Mr Hayes. Now, who have I got next? I cannot see the hands. Okay, Ms Terpstra and then Ms Bath after that, and then we will continue doing the rounds. Ms Terpstra.

Ms TERPSTRA: Thanks, Mr Chair, and thanks, Mr Mundy, for your presentation. Just a question about the longevity in terms of cost comparisons. I guess there are two parts to that. Over the longer term can you sort of talk or take us through what the cost of decommissioning might be for these types of reactors? How does it stack up compared with the conventional or the typical reactor that is out there now? And what is the life cycle like? Does it differ to what is there now? Can you just talk us through a bit of that and the cost and how that stacks up over the longer term?

Mr MUNDY: Sure. On the decommissioning, we actually prepared an initial decommissioning process based on what it would cost to decommission a current large pressurised water reactor power plant at roughly around the same output—600 to 800 megawatts. And because of the differences in simplicity of our design we believe that the cost will be quite a bit cheaper and easier and quicker to decommission than you would find for that comparative power plant. In the US you are required as a nuclear operator to contribute to a fund over the life of the plant that will ensure that there are sufficient funds available at the end of the life of the power plant to decommission that facility. We estimate that that fund needed to decommission a NuScale plant is somewhere in the order of $400 million to $500 million in present value in comparison to amounts that are substantially more for these existing nuclear power plants, because of the simplicity. For example, the power modules are delivered to the site, and in 60 years or 80 years, when the life of those modules is complete, they could conceivably be removed, just like they were delivered, after they are defuelled and decontaminated and there is some shielding. But the simplicity of removing the entirety of the nuclear steam supply system in comparison to what you saw on that graphic on slide 5, where you have to deconstruct the building and remove those individual components—it is quite a bit more complicated than the NuScale technology.

When you ask about life cycle costs, are you talking about just the levellised costs of electricity or—

Ms TERPSTRA: Well, over the life cycle of the plant, because what I understand is that obviously these things have a period of time for which they can operate and then they need to be decommissioned. Does it stack up in comparison with what is there now, and how long is the life cycle? Is it 20 years, 30 years, 50 years—what is the expected life span, I guess, of what you are proposing of NuScale?

Mr MUNDY: The power modules in the US—you obtain a licence to operate the equipment for 40 years but they have been designed for 60, and most nuclear power plant operators have extended the licence of their existing plants beyond 40 to 60 years. Then some are actually in the process of pursuing another 20 years. It is probably likely that we could extend ours. We have not gone to that evaluation yet; it is years away. But suffice it to say the technology has been designed for 60 years of life. And also the technology is quite a bit different in that, as I mentioned, with the useful life of the module being exceeded, it is quite possible that new modules ultimately could be delivered to that site and new modules installed and the facility continue to generate electricity beyond that life of that original module with a newly installed, newer version of that technology.

The CHAIR: Thank you, Mr Mundy. Can I ask members if we can restrict it to two questions for the time being because we got half an hour to go? Can I go to Ms Bath please?

Ms BATH: Thank you, Mr Mundy. Thank you for your presentation. It really comes off the bat of Mr Hayes's question in relation to cost comparisons. I know you have talked quite a bit about it just now, but have you got a table that really compares your particular modules to other forms of larger scale nuclear power plants? And also how does it stack up against other forms of generation? That can be taken on notice, if you could provide that to us, and I guess what validity you had to base that on. And then the second one goes to employees: in this country we, like at no other time, need to have a workforce operating when we are producing our power. So my question goes to: what type of workforce is required to operate either one unit or, if it is in that stack of 12-module plant, what does that look like? And the units—are they completely imported or is there some component of labour that can be used in manufacturing in Australia?

Mr MUNDY: Okay, well, there were a few questions—three questions—there. Let me first address the comparison of our technology in terms of levellised costs of energy to other forms of generation. We generally do not try to compare the technologies because there are a number of variables that go into computing what the levellised cost of energy is, but the US Energy Information Administration, which I believe is a division of the US Department of Energy, annually produces the levellised costs of new generation resources in the US. It is a helpful comparison because it is a like comparison. They use the same assumptions—financial modelling assumptions, product lifetime and a number of other things—to be able to compute the levellised costs of electricity across a variety of generation sources for that year.

So I am looking at, in front of me, the 2019 EIA figures for both NuScale and other forms of generation. To give you a sense, a municipal finance power company customer for NuScale technology is roughly around $65 per megawatt hour. To put that into comparison, ultra-supercritical coal is $76 per megawatt hour. Combined cycle gas is $67 per megawatt hour, and that assumes a certain price of gas. Offshore wind is $40 per megawatt hour, onshore wind is $122 per megawatt hour and solar PV is probably the lowest at $33 per megawatt hour. Now, our technology in terms of the customers looking at large base load or flexible base load and flexible operations is usually being looked at in comparison to coal with carbon capture sequestration or combined cycle gas with CCS, and our technology is clearly competitive with those two forms of technology on a levellised basis.

Now, your next question: workforce. We estimate that a NuScale power plant, a 12-module facility, a 720-megawatt facility, will require somewhere around 300 people to operate and maintain that facility. That is substantially less on a per-megawatt basis than you will find in a current large commercial nuclear power plant. That lower O&M makes our technology more competitive from an operational and maintenance cost perspective—but roughly 300 individuals.

We have also recently studied, for example, the kinds of individuals that we needed to run a NuScale power plant in comparison to individuals that run a coal power plant. In the US there is a lot of coal generation that will be retiring between now and 2050, and we looked at whether the skill sets of individuals at coal plants, for example, could operate a NuScale power plant. We found that for the most part most of the positions in a coal plant could readily transfer into similar positions in a NuScale power plant. The nuclear-specific positions, such as control room operators, could also be qualified in those positions with a very reasonable cross-training-type program, and that is due to the simplicity of the technology and the fact that most of our power plant design uses very similar kinds of thermal generation pieces of power equipment—pipes, pumps, valves, heat exchangers. So those individuals that are used to maintaining and taking care of that equipment in coal plants could also do that for NuScale power plants.

Your last question was—I cannot read my own writing here. Could you refresh my memory on the last question?

Ms BATH: Thank you, and sorry. There will be a time, Chair, when I only ask one question. It relates to: do these come into Australia already made or can there be components that are made on a domestic scale here?

Mr MUNDY: Right. So the nuclear components, like the NuScale Power Module, are what the nuclear regulator would say would have to be a 'nuclear-qualified' piece of equipment, so only vendors qualified to make, in this case, large nuclear pressure vessels would be able to produce that equipment. Most of the other equipment, though, in NuScale's power plants, as I mentioned, are thermal generation pieces of equipment. To the extent then that there are companies in Australia that can make pumps, valves, piping, equipment, circuit breakers, heat exchangers—those kinds of things—they could be sourced and installed in a NuScale power plant. The nuclear-specific, to the extent that you have qualified vendors in Australia that can produce nuclear-specific equipment—and you probably do because you have some nuclear capability; your ANSTO national laboratory is a good example of equipment that goes into that facility that has to have that nuclear pedigree—there is probably opportunity for companies in Australia to produce some of the nuclear equipment as well. There are not a lot of companies worldwide that can make those big nuclear pressure vessels, but there are several. I do not believe there are any that I am aware of that are in Australia.

The CHAIR: Thank you, Mr Mundy. Can I go to Ms Taylor, then Mr Limbrick and then Dr Bach in that order. Ms Taylor.

Ms TAYLOR: Thank you, Mr Mundy, for your submission. In February you wrote to the committee, or NuScale wrote to the committee, advising that your first project will commence in 2026. In July UAMPS, your customer for the first project, advised that the first module is anticipated to come online June 2029 and that the full commercial operation date is anticipated to be in 2030. So which date is correct there? Is it 2026 or 2030?

Mr MUNDY: Recognise that those dates are not our dates; they are our customer's dates. And the customer has been developing its program now for several years. It is not a large existing nuclear power plant operator. It is taking a very deliberate and risk-averse approach to establishing its schedule to meet the needs of its members. For the most case, many of the members are small municipal power companies.

It recently presented to its membership a project plan of finance and budget, and conservatively identified to its membership that the project has directed NuScale to satisfy the dates that you mentioned—the first module coming online in 2029, full facility operation in 2030. We believe there is opportunity to move that up. And in fact our project plan that we are working to, that is being funded by the Department of Energy, still is working to a plan that ensures that we can fabricate and deliver modules much sooner than what the UAMPS project will require. So we are geared up and working to a project plan with the Department of Energy that satisfies an earlier date than what UAMPS currently requires for its membership. Now, that date is also based upon an evaluation of when the UAMPS membership requires the electricity from that power plant, and it is later in the decade than earlier in the decade. And that is one of the key reasons why that date has now moved out for its membership.

Ms TAYLOR: Yes. You can understand why we want to understand time lines to really appreciate the realistic implementation of this kind of product. So your company said it will take eight full plants before you achieve an nth-of-a-kind pricing. Assuming Australia would wait until then, what is the soonest NuScale might be ready for our market?

Mr MUNDY: Well, a lot depends on how long it would take and when we would start the nuclear licensing activities in Australia. Usually that is the critical path activity and drives the overall project schedule. I do not know exactly how long it would take for our technology to be approved in Australia. In the US our certification has taken roughly 42 months. Other countries take roughly the same amount of time, anywhere from 36 to 48 months or so. Some take a little bit less, but that is usually the critical path. But if we were to start with a project developer here shortly, it is very reasonable to believe that a NuScale power plant could be generating electricity by the end of this decade if not earlier in Australia.

Ms TAYLOR: Twenty-thirty?

Mr MUNDY: Correct. Well, 2029, 2030—correct.

Ms TAYLOR: But you essentially lost four years. There was a delay of four years from the original proposal with your first customer back in February, so it is a little bit hard to sort of really believe that, give it credence, because you have already had that slippage just here.

Mr MUNDY: No, no. Let me reiterate what I said with UAMPS: we continue to work to a project plan that is premised on the first commercial operation date that UAMPS presented to us several years ago. That was to be able to support a commercial operation date in the mid 20s. That was the basis for our award with the Department of Energy: it was to demonstrate that we could have our program, our technology, designed and licensed and be ready to manufacture and construct in 2025, and we are on a path to achieve that. So if there is another customer that would like a deployment, a commercial operation date, that is sooner than UAMPS's, depending on the licensing activities in the market, it is possible that we could have another and separate project moving forward that has a commercial operation date sooner than the newest project, and in fact we are talking to another customer in the US and another in North America that have already set a project objective date earlier than the current 2029 UAMPS date that you mentioned.

The CHAIR: Thank you. Can I move now to Mr Limbrick, please?

Mr LIMBRICK: Thank you, Chair, and thank you, Mr Mundy, for appearing today and your presentation. You stated in your submission that Australia would be an ideal place to go forward with this sort of technology. My first question is: why do you think that? Secondly, you also mentioned something that was interesting about replacement of coal. You may be aware that in Victoria we are removing a lot of our coal. Generation is reaching end of life, similar to what you have mentioned in the US. I would be interested in hearing about that. And, also, if we did lift nuclear prohibition in Australia, would this be a market for which your company would be interested in going through that licensing and marketing process?

Mr MUNDY: Okay. So on the first question—why is it a good place?—well, there is customer interest actually. We are talking to companies that are interested in developing our technology in Australia, should they be granted the ability to do so. That kind of answers your last question as well.

Mr LIMBRICK: Yes.

Mr MUNDY: So it is an attractive market from a business development perspective for us, but it is also a market to where we think it would fit well within the electricity system. We know that there have been system reliability issues in the marketplace there—you know, loss-of-power events in the system. There is quite a bit of build-out of renewable generation. But generally we find, and market studies will show, that the lowest cost solution to high renewable penetration in the market is to firm that capacity with a zero carbon generation solution like NuScale's technology. In reports recently issued in the Pacific Northwest, for example, a power company there said that achieving 100 per cent renewable generation in that market with SMRs deployed at the price point of NuScale will save them $8 billion a year in capacity build-out and produce the lowest cost electricity on the system. We see your country as a market that has similar-type issues: low-carbon objectives and the need for a resilient and reliable transmission system, and our technology fits extremely well in those kinds of markets. Lastly, what was your coal question? I am sorry.

Mr LIMBRICK: In Victoria, we have a situation similar to what you stated with some of your current potential customers in that we have large coal-fired power plants which are nearing end of life and we are currently figuring out what to do with that, including workforce issues and all of these other things. How do you think that would fit in with the decommissioning of those plants plus our high variable renewable strategy that we are going towards in this state and in other states in Australia?

Mr MUNDY: Right. It is a very similar situation as the US—we have power companies that are looking at their integrated resource plans: what do they do to meet the needs of their system when their ageing coal plants retire? They obviously have objectives for a certain amount of renewables and other forms of generation, but they realise they need a diversified portfolio for the reasons that I mentioned. NuScale power plants, with their simplicity of design, make it very attractive to use that coal plant workforce to operate the NuScale power plant. Our technology will fit well on those sites from an environmental impact and a physical footprint perspective. The tremendous safety case will allow our technology to be sited on coal plants where the communities may have grown up around those facilities over the years and the population density around them may be higher; because of our safety case, that is not a problem for our technology. The simplicity of the design allows that coal plant workforce to easily transfer over to the NuScale plant, and it results in repurposing that facility.

And I failed to mention that we estimate on average around $100 million of existing coal plant infrastructure could be directly used for a NuScale power plant, saving costs of development and making it simpler for the overall project development plan. So it is very attractive and we are getting a lot of interest, particularly from customers doing their IRPs, their integrated resource plans, and looking at what to do with these coal power plants that are going to retire. And it continues to allow that economic prosperity that those plants have provided to the community to continue by repowering that coal plant with a NuScale power plant. It is a real win-win situation. And in the US because of the amount of coal that will retire we are seeing tremendous interest in our technology.

Mr LIMBRICK: Just with the existing infrastructure, you are talking things like transmission infrastructure and things like that?

Mr MUNDY: Transmission; water supply systems; potable water; any kind of facilities that can be used for training, administration, supply warehousing—all of those things will not need to be rebuilt if they already exist for the coal plant proper.

Mr LIMBRICK: Thank you, Mr Mundy.

The CHAIR: Thank you. Dr Bach?

Dr BACH: Thanks a lot, Chair. And thanks for being with us today, Mr Mundy. Like other members of the committee I am concerned about cost, and you have already been asked several questions about cost. And I appreciate your really detailed answers. It will not surprise you to learn, Mr Mundy, that as a committee another concern that has been raised with us is regarding waste and the disposal of waste. So could you talk to us perhaps about your plans in the US to deal with waste? And perhaps you could also respond to the broader point: for some people, and for some people who we have heard from as a committee, the fact that nuclear waste is obviously a by-product of this process is a deal-breaker in and of itself. And I understand that. So perhaps you could respond on both of those levels, Mr Mundy.

Mr MUNDY: Well, our plants, in the initial instances, were being licensed by the US and were being deployed in the US. We have certainly designed a plant that satisfies all of the waste treatment, handling and disposal requirements that are set forth in US regulation. So that is dealing with the production of solid, liquid and gaseous waste as well as the used fuel. Now, the technology in terms of the first three has been designed to produce those kinds of wastes better than the top quartile that exists in the US with the existing fleet, and the existing fleet produces very, very low quantities of low-level or medium-level waste in the form of gaseous, solid and liquid wastes. For example, we would be run as a zero discharge-type facility. Whatever water we create, we process it and we re-use it back in the system, not having the need to discharge any of that.

But it really comes down to what happens with the used fuel. We design our technology—and it will be approved by the NRC—to satisfy the current regulations. So we have the means to wet-store the fuel for about 10 years—all the fuel that is produced—in what we will call a fuel pool, so it is just a pool of water, at which point it would be removed and stored in what is called dry cask storage. So they are very robust and hardened containers that hold a certain number of fuel bundles. And we have set aside a 2-acre area within the protected area boundary of the facility to store those used fuel bundles in dry casks until such time in the US as there is a long-term repository to take those fuel bundles.

Under what is called the Nuclear Regulatory Commission's waste confidence rule, it says that it is acceptable and safe that those bundles be stored at a nuclear power plant site for at least 100 years beyond the operation of the facility, essentially giving time for the issue of how to deal with the ultimate disposal of that fuel, whether that might be just, for example, a deep geologic repository or perhaps even reprocessing of the fuel if the US were ever to change its policy on that. Most countries that we are also dealing with that have existing nuclear programs are looking at or have a long-term geologic repository as the plan for dealing with the used fuel. In the interim, until that will be implemented, they will also likely implement this form of dry storage that I mentioned. And I would expect that if we were to deploy in your country, until your country has decided what to do with the used fuel, you would probably examine a similar type of option for the nuclear plants that are deployed in Australia.

The CHAIR: Thank you. I need to move reasonably quickly now. Can I ask Mr Meddick, if you have a question or two?

Mr MEDDICK: I do; I have two. Thank you, Chair, and thank you, Mr Mundy. I would like to also acknowledge that Ms Collins is here from NuScale, and I am happy for Ms Collins to jump in at any point and answer any of these questions as well. Look, my questions both relate around waste as well. This committee recently undertook an extensive inquiry into waste management, and a key recommendation of that was that companies across every single industry sector would hold responsibility for product stewardship. Now, in your instance that would mean that by selling a reactor into Victoria you would potentially be responsible for all aspects of the management of the waste generated in the entire lifetime of that plant and the entire lifetime of that waste. Have you calculated what costs that would incur into the selling price of your reactors into Victoria given that you would have to build, you would have to staff and you would have to maintain any waste contaminants at a facility associated with that waste by your product and that by extension you could also be responsible for the same in the decommissioning process?

My second question relates to that storage of the waste. Does it not strike you that it is a somewhat irresponsible position to take, storing a highly toxic and highly dangerous material for 100 years somewhere on the never-never promise that technology might—might—sometime in the future be established and made available for dealing with that waste? I would think the broader community would find that that is like going to a casino and laying a bet on either red or black and hoping that your bet actually comes up and the technology becomes available. Would you not think the community might feel that way?

Mr MUNDY: Well, if a community has been directed to be the recipient of the long-term disposition of that fuel, I suppose that would not be a favourable situation to be in. We have designed our technology to comport with US regulations. In the US the ultimate owner of the used fuel is the Department of Energy, so it is the federal government's responsibility to determine how it will deal with the long-term disposal of nuclear fuel. The solution that has been selected but not yet licensed has been the long-term geologic disposal of the fuel in these high-integrity casks that they will be in. At least in the US that is the responsibility of the US government. The waste confidence rule that I mentioned which the NRC sets forth that the NRC has the confidence that the issue will be resolved so that ultimately that fuel that will be stored on an interim basis at the nuclear facilities will at some point in the future be stored somewhere else.

In terms of the ability to store that, it is primarily not a technology issue. We do have the technology today to safely contain the used fuel—notwithstanding that reprocessing is always an option, but it is currently not by policy in the US. But long-term storage is technically feasible. What has not been achievable in the US is deciding where that repository will be located. That has been a non-technical issue to deal with. I do not know how that will be addressed currently in Australia.

In terms of whether we have factored into the cost of satisfying the obligations that you mentioned in a regulation that you cited, we have not. The price point that I showed earlier for the deployment of a NuScale plant in the south-eastern US has all the costs associated with what we need to do to satisfy our obligations under US law and also what cost the customer would incur, because we provide that to the customer to determine what its levellised cost of electricity will be.

The CHAIR: Thank you. Look, we are running out of time. Can I ask Mrs McArthur for a quick question, if possible, and I know Ms Taylor has got a follow-up question. If members have further questions, they can email them to the secretariat—to Michael. Mr Mundy, I take it you will be happy to answer questions in writing later on?

Mr MUNDY: Certainly.

The CHAIR: Mrs McArthur.

Mrs McARTHUR: Thank you, Chair, and thank you, Mr Mundy, for your incredibly comprehensive presentation. My question is quite simple: in layman's terms in what ways are SMRs fail safe?

Mr MUNDY: Well, I mentioned that briefly. One aspect of the technology—I do not like to use these words, but some do—is it is 'walk-away safe'. As I mentioned, our technology has an indefinite coping period. There is really no design-basis event that can cause the failure of fuel in our technology, and we are required to examine an assortment of things that could happen with a very low probability—nonetheless, if they did happen, what would be the consequences? And there is no design-basis event that causes fuel damage. But as I mentioned, in the event where the plant loses all power—and as I said, everything automatically shuts down and it self-cools for an indefinite period of time—that is hypothetical. In reality, when that happens the facility owner and the operators and technicians are all working to restore the facility to operation, trying to get the operation of the facility back to making electricity. So that is a hypothetical scenario, but nonetheless it demonstrates that even if that were to happen, that is a fail-safe type of design capability of our technology.

Mrs McARTHUR: Thank you. I guess there is no time for a second question, Chair? Chair?

The CHAIR: How about I unmute myself. Are we able to forward the questions to Michael?

Mrs McARTHUR: Yes, sure.

The CHAIR: That would be great. Ms Taylor, is that okay? Ms Taylor has got her hand up for a very quick one. Okay, a quick question—it had better be quick.

Ms TAYLOR: All right. Your submission from February claimed that the first-of-a-kind cost for NuScale would be US$2.97 billion, and I think you spoke to that earlier. In July UAMPS advised that the full acquisition and construction cost of the first plant is currently estimated at US$6.12 billion. Which is it: $2.97 billion or $6.12 billion? Are they different estimates for the same thing? Has the cost gone up by a factor of two in the last six months?

Mr MUNDY: Quickly, the $2.9 billion is for the generic site. That is an overnight cost. It does not include warranty, contingency, fees, profit, interest charged, owners costs and a number of other things. That is just the cost if you were to build it overnight and what you would pay. The $6.1 billion is a very conservative estimate which includes contingency and these other components—interest, which is a very large component when you are talking about financing a power plant that costs $3 billion. That is the difference between essentially $3 billion and the higher number that UAMPS has identified to its customer base as to what the total project cost will be if everything is incurred, all the contingency is used up, all the fees are paid—all those kinds of components.

The CHAIR: Thank you, Mr Mundy, and I remind members that should you have any further questions, please forward them to the committee manager and then he will forward them to Mr Mundy. Mr Mundy, thank you very much for your time and also Ms Collins. We appreciate your valuable time and contribution to this inquiry. A copy of the transcript will be emailed to you. So if there are any changes, mistakes or omissions that need to be corrected, please do so, because the transcript will eventually be published on our website. So thank you very much. All broadcast and Hansard equipment must be now turned off.

Witnesses withdrew.