

# **ECONOMICS AND INDUSTRY STANDING COMMITTEE**

**INQUIRY INTO MICROGRIDS AND ASSOCIATED TECHNOLOGIES IN WA**



**TRANSCRIPT OF EVIDENCE  
TAKEN AT PERTH  
WEDNESDAY, 16 MAY 2018**

**SESSION THREE**

## **Members**

**Ms J.J. Shaw (Chair)  
Mr S.K. L'Estrange (Deputy Chairman)  
Mr Y. Mubarakai  
Mr S.J. Price  
Mr D.T. Redman**

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**Hearing commenced at 11.06 am**

**Ms MICHELE DIANNE CLEMENT**

**Manager Secretariat, Technology and Industry Advisory Council, examined:**

**Professor LYN BEAZLEY, AO**

**Member, Technology and Industry Advisory Council, examined:**

**Mr JOE OSTOJICH**

**Deputy Director General, Department of Jobs, Tourism, Science and Innovation, examined:**

**The CHAIR:** On behalf of the committee, I would like to thank you for agreeing to appear today to provide evidence in relation to the committee's inquiry into microgrids and associated technologies in Western Australia. My name is Jessica Shaw. I am Chair of the Economics and Industry Standing Committee. I would like to introduce the other members of the committee. To my right is Yaz Mubarakai, member for Jandakot; to my left, Deputy Chair, Sean L'Estrange; Stephen Price, member for Forrestfield; and Terry Redman, member for Blackwood–Stirling. It is important that you understand that any deliberate misleading of this committee may be regarded as a contempt of Parliament. Your evidence is protected by parliamentary privilege; however, this privilege does not apply to anything you might say outside of today's proceedings.

Before we begin with our questions, do you have any questions about your attendance here today?

**The WITNESSES:** No.

**The CHAIR:** Would you like to make short opening statements?

**Ms CLEMENT:** Yes. I would just like to introduce the Technology and Industry Advisory Council. It is governed by the *Industry and Technology Development Act 1988*. It provides independent strategic advice to the Western Australian government on innovation, industry, science and technology that drives economic growth and diversity in the state. The chair of TIAC, Mr Alan Bansemer, wishes to pass on his apologies for not being able to be in attendance today. Thank you.

**The CHAIR:** Thank you.

**Prof. BEAZLEY:** I would like to thank you for the opportunity to actually come and share what is really an important issue, particularly for rural, regional and remote Western Australian, and looking to the future where we can use renewable energy in a really positive way to benefit communities, but also to cut down the carbon footprint.

**Mr OSTOJICH:** Madam Chair, thank you for the opportunity. Our Department is involved in a variety of different activities that revolve around mineral exploration and development, but we are not specifically about microgrids, although we have exposure to them over a period of time. What we do, though, is track what is happening in the new energy sector, particularly the various projects that we have that revolve around lithium and related materials. My role here really is to supplement TIAC—the information that they've been able to provide.

**The CHAIR:** Well, thank you very much for that.

**Mr OSTOJICH:** Madam Chair, just before we finish on that. Depending on the line of questioning, some of the material that I may be providing to you could be both commercially sensitive and market sensitive, at which point I would rather that that not be public information.

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**The CHAIR:** Absolutely, and certainly the secretariat advised me of that before the hearing this morning. If we are straying into territory where you feel uncomfortable, please let me know.

**Mr OSTOJICH:** Sure.

**The CHAIR:** You can either provide it to us as a supplementary submission that we can receive in confidence or we can hear evidence in closed hearing. It would be good to get as much onto the public record as we are able to, but certainly I appreciate and understand some of the commercial sensitivities that potentially present in this sector.

To give you an understanding of the process that this committee is adopting with respect to this inquiry, we have broken it down into two parts. The first part of this inquiry is very much about scoping the opportunity. We are looking both at the benefits that microgrids and the technology deployment associated with them offers to energy production system, and also what the rollout of these solutions would mean for associated industries. So, certainly one of the things that we are very keen to understand is the material inputs into these sorts of technologies, the potential for innovative industries to emerge in advanced manufacturing and workforce development issues. That sort of upstream part is certainly something that we are actually very keen on receiving information about. We have had already quite a bit of evidence from the electricity sector and the energy sector itself about these opportunities, but understanding the opportunities in advanced manufacturing and mining and resources and what it would take to enable that is a really key component of this point that we are at in the inquiry.

Subsequently we will move on to the barriers, and I thank the TIAC for its submission. The submission that you have provided to us is very geared towards the second stage of our inquiry, so I think at this point we will be focusing very much more on scoping the opportunities and understanding the value chain, but there will be opportunity later on, after we have published a stage 1 report, to examine some more of these regulatory market structuring and the sort of signals end of microgrid deployment themselves. That will be something that we will come to later.

With that in mind, we have had some really quite interesting evidence this morning on the lithium industry in particular. I wondered if, from the state government's perspective, you might be able to, Mr Ostoich, give us a bit of an overview of what the State Government's plans are in that area, what is being done to encourage these sorts of projects to come on stream—or mining projects to come on stream—but then also in those advanced manufacturing or those, I guess, intermediary stage opportunities, what is happening there?

**Mr OSTOJICH:** As it happens, I am in the process right now of putting together a taskforce that is going to inform the Government about what kind of strategy ought to be pursued relating to new energy generally. This is really about new energy and battery storage facilities. It relates to the opportunity that the State has been given through the development of the market for lithium—the reason being we are now one of the world's biggest, if not the world's biggest, exporter and developer of lithium.

Now, the reason for that largely is because the other major lithium producers, which are all in Latin America—material that is extracted from brine rather than hard rock—pursued some policies which did not really wash with the market. The policies they pursued and the opportunities they saw—this is Chile, Argentina, Bolivia; largely those three—is to have downstream kind of processing. The caveat that they put on any exports, and they saw it as a strategic mineral and therefore a strategic export, and the limits they imposed on that were to buying companies, the buyers around the world. They said, you know, “We will sell you this stuff, but you need to make some investment here about downstream processing.” Of course, they did not. They looked for other opportunities for that and those other opportunities, thankfully, were in Western Australia.

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The other competitive advantage that we have is the fact that we have got hard rock lithium as opposed to brine-sourced lithium. That gives a certainty of supply at a very high quality over a period of time. The reason it is certain is because the brine-sourced lithium is subject to weather conditions. If you get heavy rain and heavy fresh water encroachment into the brine fields, that limits the amount of processing or you need more processing to do it. All of that notwithstanding, if the Latin American producers and developers started to actually get their act together—sooner or later they will—they produce lithium at a far lower level of cost than we can at the moment.

**The CHAIR:** Just to tease that out, relating to getting their act together, is the same regulatory framework, though, still sitting around that? The same policy —

**Mr OSTOJICH:** No, they are changing that—and particularly in Chile.

**The CHAIR:** Yes.

**Mr OSTOJICH:** They are certainly changing that and liberalising the way that they actually provide the lithium.

**The CHAIR:** Is that in response to a market signal to say, “If you’re going to require this of us, we are just going to take our capital and invest it somewhere else”?

**Mr OSTOJICH:** Yes, and that is essentially what was happening.

**The CHAIR:** Yes.

**Mr OSTOJICH:** It was clear to them that pursuing that policy just was not going to work and has not worked.

**The CHAIR:** What are they doing differently now? Is there any sort of tiered downstream industry development obligations at all?

**Mr OSTOJICH:** Not that I am aware of and we are ahead the game there too now. Because we have stolen the march on them, we have now got a number of investments that have taken place here, one of which is a company called Tianqi, which is a Chinese company, and we will end up with three of the world’s four largest producers of lithium here. The four are: Albemarle, which is a US company; Tianqi; a company called FMC, who is not here; and the fourth of those is SQM, which is a Chilean company. SQM have in the last couple of weeks announced an investment in conjunction with a company called Kidman Resources and they are now operating as WA Lithium and have just announced that are going to be in Kwinana.

Of those three that are here, Tianqi, who was an early mover in this, actually took the lithium from its spodumene lithium stage to carbonate and hydroxide. That is a serious move to downstream processing and that will happen here, because they are completing that investment now. The stage that they are not taking it to at the moment is ion—lithium-ion.

**The CHAIR:** What do you think it would take to get to that stage? What signals need to be sent or what is it going to take to move on and get us in that next step in the value chain?

**Mr OSTOJICH:** It would take an investment decision by one of those. The people that are kind of in the box seat on this is Tianqi. They need to make an assessment of their own ability to supply that market chain and say, “Yes, this is what we need to do” and move to lithium-ion, which can be easier and better—and cheaper, hopefully—processed here in Kwinana rather than in China or South Korea or Japan. That is a commercial decision that they are going to need to take. It seems to me that all the conditions that are present in the market structures at the moment would kind of encourage them to do that, but it is an iterative process. They have gone from stage one, which is the beneficiation of the ore to the production of lithium, and now they have made that commitment

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and decision to go to carbonate and hydroxide, and hopefully they then see the next part of that chain to go to lithium-ion.

**The CHAIR:** I guess what I am seeking, and I will be more direct is: are there any government incentives that could potentially be put in place, or regulatory changes, or some sort of industry development policy that could be introduced to encourage the establishment of that next step in the process?

**Mr OSTOJICH:** The answer to that question is that there are no current incentives in place. One of the things that we will be doing when we examine through the taskforce process that we have set up—that is a key question, about how is it that we can incentivise this. Do we need to incentivise this? Is there a market failure where that kind of incentive is required and, if there is, how do we go about correcting that market failure?

**The CHAIR:** Who is on the taskforce and what are the terms of reference for it?

**Mr OSTOJICH:** We are developing the terms of reference right now. The taskforce is to be chaired by Minister Johnson and it will include all the key agencies that are associated with that: DMIRS, ourselves, DPIRD and Treasury I think is going to be on it. It is going to have a very broad representation, but sitting outside that main frame of people is also going to be the industry side and the stakeholder groups that are going to be feeding into it. We are going to divide that into work streams where various parties are going to be responsible for any number of things including economic activity, market failure, incentivisation and all those sorts of things.

**Mr D.T. REDMAN:** There is a number of comments that you made in your paper in respect to the network and the impact over time of network investment. Your paper makes suggestions about the network reducing its debt, which is I think a third of State net debt or something like that. Can you make some comments about some of those other issues that are embedded in that question; that is, uniform pricing tariff policy, technology as it applies to the fringe of grid, and I guess the interaction with those network costs?

**The CHAIR:** Can we park that for the second stage of the inquiry, though? Is that not more about the second stage?

**Mr D.T. REDMAN:** It is just in the submission, that is all.

**The CHAIR:** Yes, but if that is okay, because it gets us into very complicated territory and I think it would be good to give that a more fulsome hearing at a later date.

**Mr D.T. REDMAN:** No, that is fine.

**The CHAIR:** What about the TIAC's views on the opportunities that are presented here for industry to innovate, respond and get involved in the supply chain as well?

**Prof. BEAZLEY:** I think there are tremendous opportunities. We actually have a very strong history in the academic aspects of this from Curtin University and Murdoch University where we were actually world leaders in developing lithium batteries way back. We have an opportunity I think here for innovation by taking advantage of our tertiary institutions and the research that is there. We can build on that even further. I think that is one aspect. I think it is also important that we look at how we teach it at universities to make sure that they really are up to speed. They are very anxious to be, I think, at the forefront of this area so the opportunities are there.

I think there are opportunities for industry, too, to look at innovations in terms of the efficiency, looking at occupational health and safety, which is always key in this area, and looking for how we can deliver these whole systems cheaper and better. For me, this is an enormous opportunity,

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building on our history, building on the resources we have in brainpower here and the relationship between our universities and the companies involved are growing all the time.

I think, Joe, you would probably be able to reinforce that comment that we are looking for synergies there. That is one whole aspect but, of course, the other aspect is looking at rural, regional and remote communities and seeing the opportunities there for a better lifestyle, for more opportunities right through the education system and in terms of employment. We can actually start developing industries we have not had before. We have mentioned the resources sector and that is terribly important but agriculture, too—niche agriculture—where we can look at the potential. For example in South Australia, virtually all the tomatoes we now eat come from a system where you take sea water and use energy—it is solar thermal in this case—to actually desalinate that water and then heat greenhouses. These are opportunities that we can develop, but we can develop it only when we have a reliable power supply to back it up, and one which is cost-effective. So I think there are wide opportunities here. You would probably like to comment on that further, Michele.

**Ms CLEMENT:** Yes. Microgrids can also bring in greater competition in looking at different solutions—not necessarily different retailers, but the different solutions of delivering energy more efficiently. It is also looking at that ability to develop more resilience and capabilities, particularly again, like Lyn said, in regional and remote areas or areas that are at risk of environment factors like bushfires and high winds that will knock out our old system of lines and grids. Some of those coming through will again have that flow-on effect of supporting the economics of the town. For example, in Kalbarri, they are looking at doing this new microgrid. The support of that will support our tourism industry and the local businesses. There will be a little bit more sustainability so there is that flow-on effect of why microgrids are important in regional and remote areas.

**Mr OSTOJICH:** I do have some preliminary thoughts. The thing that is going to limit us going forward is that we do not have all of the elements. We have most of the elements of what you would need to produce the batteries that you would need to produce. We have got cobalt, nickel, we have certainly got lithium, and we have got copper. The thing we do not have is graphite. Ninety per cent of the world's graphite is in China and they are not going to sell it to you, because they see it as a strategic asset and they will not give it to you. They will not under any circumstances do that. There is a little bit of graphite in Africa, in some African countries. We have got some lower end graphite somewhere in Western Australia, but there is no serious activity around that.

Then the question is: what do you do? The substitute for that has got to be some kind of artificial graphite, and that is precisely what we are pumping some money into to do some research through one the CRCs, and that is one of the things we are trying to do. In terms of preliminary thought about the outcome of how you bring this together, my preliminary thought is this: we continue to provide the capacity to be able to advance the various projects that have been in train and new projects that will come up. That means that you will have strategically designated industrial land that you can put these people onto, whether it is in Kwinana, Kemerton, Mungari or wherever it might be.

Part two is that you then move and encourage downstream processing as far as you can take it, hopefully to lithium-ion. Part three is that you then do some work on the missing elements, which, as I have just outlined, is by and large about graphite. Part four is then, it would seem to me the sensible thing to do, to engage with the various manufacturers of batteries in different parts of the world—by the way most of them are in north Asia somewhere—and outline the strategic advantage of them being here. But we have got to identify what the strategic advantage is. They are not going to simply make those investment decisions based on climate, clean air or whatever it might be.

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There has got to be some kind of strategic advantage that overcomes the issue of proximity to market—that is, to end market.

Clearly, given the size of our economy, those factors are not going to be overcome simply by our own domestic market, no matter how big our consumption of battery energy is going to be. In terms of preliminary thinking about this, they are my thoughts on it. There is absolute necessity to bring energy storage capacity into the equation, because that is really going to be the game changer, and energy storage is a critical economic issue for some of the microgrids that develop around, say, remote mine sites.

Just to give you an idea of just what a disadvantage they particularly have in terms of energy capacity, we have got a remote mine site in the Goldfields that is remote from Kalgoorlie and out the back of somewhere, to get some electrons of electricity into Kalgoorlie it is going to cost you about \$48 a megawatt. If you are going to do that with solar at the moment, it is going to cost somewhere in the region of about of about \$70 or so a megawatt—coming down. Wind generation of the type that you see in Albany is probably around \$120, because it is old generation. The newer generation stuff is closer to the PV cells that are there, so around \$70. So, clearly the capacity to supply grid power into Kalgoorlie is by far the best option for the moment.

Compare those figures to what you would find on a remote mine site where the need for power is overcome with the use of diesel and generated through diesel engines, that costs about \$250 a megawatt. That is about five times as much as grid power, so imagine what that does to a commercial enterprise that is trying to shave its bottom line. If you are able to overcome these issues and introduce storage capacity into the equation, you are going a long way to creating some seriously game changing economic structures.

**The CHAIR:** Just thinking on the point of competitive advantage, and this question has just popped into my head and I do not know whether you are able answer it—one of our previous witnesses may have been able to. I am just curious about the actual energy intensity of the lithium supply chain. We are looking at the evaporative ponds for one technique for producing lithium. Hard rock seems to be the basis of this particular technology, so I wonder about the energy intensity of that process—its initial phase and then subsequent phases. We start looking at the production of commodities like alumina and silica here in WA, and they are energy made solid and exported. When we are producing those commodities, it really is an energy conversion export that we are doing. What is lithium like relative to that? Do we know? Do you know?

**Mr OSTOJICH:** Yes. I cannot give you exact dollar figures, but I can say that compared to brine, it is very much more expensive.

**The CHAIR:** Brine.

**Mr OSTOJICH:** The brine stuff, as you say, solar evaporative, so you really taking solar power and cutting out the middleman—you are cutting out the PV cells, you cutting out everything and evaporating the ponds and manufacturing lithium that way. Where you have got hard rock lithium, or hard rock anything, and you need to introduce a beneficiation process, that is seriously energy intensive.

**The CHAIR:** And then the next phase?

**Mr OSTOJICH:** The next phase is to bring it into a lithium concentrate, which is not as energy intensive, but it is still energy intensive, to transform it into carbonate. Once again, there is an intensity there, but nothing like the initial beneficiation, and hydroxide is exactly the same.

**The CHAIR:** I am just thinking to points of competitive advantage, because in a previous life I did the gas connection for a lithium production facility in the Kwinana area—the initial commercials around

getting them the gas they needed in order to undertake the process—very early on with the initiation of that project.

**Mr OSTOJICH:** The big Tianqi project you mean?

**The CHAIR:** In Kwinana, yes. I am thinking about points of advantage that Western Australia may have over other jurisdictions, and obviously secure access to a plentiful gas supplier, which is a key input into process based on a domestic gas reservation policy that sits there and guarantees a volume of gas at a reasonable price at a time when we see escalating gas prices and supply uncertainty on the east coast—you would have to think that that would be some sort of advantage that Western Australia might have over other jurisdictions.

**Mr OSTOJICH:** We certainly do, and from the point of view of gas, yes, of course we do, particularly at the moment. The market is soft on gas anyway, but given the various gas projects that have come on, which include Gorgon and Wheatstone, as well as Pluto, that have been in the field and now the potential expansion of Pluto with the Scarborough gas that is going to come into it, what you have actually got is the capacity to pretty much outstrip, and seriously outstrip, the demand structures in the market. What that means from a domestic gas point of view is that the market is going to remain, I assume, fairly soft for probably a decade or thereabouts.

The thing about our domestic gas policy is that it is a reservation policy, which means that you do not have to force these producers to sell gas at unreasonably low costs into the market, because it is reservation. So, if they cannot sell it or will not sell it, they would need to reserve for the future, which means that the oversupply hump at the moment that goes over the demand line can be stretched into the future. I anticipate that we are going to have fairly reasonable energy prices for some time down the track. Our current price, as I understand it, in the market is between \$4 and \$6 a gigajoule. It can be a lot lower than that, depending on the quantity that you are going to buy, but if you compare that as a baseline price to what happens on the east coast, you are dealing with about \$9 a gigajoule. That is a serious difference. In some cases, depending on how you get it and how you source it, it is double.

So, yes, energy input costs, feedstock energy, is an advantage, no question about that, but in terms of any kind of input that goes into the process for developing lithium and other products that are associated with it that has any kind of labour input costs, clearly, we are going to struggle to compete with what China is doing, and, to a lesser extent, but still, with what Korea is doing—Japan is a different side of things—but those two markets in particular. The question really ought to be what then gives us a competitive advantage, and the real competitive advantage is that if you do these things in China, which was the alternative for companies like both Tianqi and Albemarle, you cannot ship it out of China, so the capacity to be able to access markets in north Asia, the United States and Europe is limited.

**The CHAIR:** Why can they not ship it out of China?

**The WITNESSES:** Because they see it as a strategic product and they have the capacity to restrict it. They certainly would not sell it, for instance, to Japan.

**Mr S.J. PRICE:** But they can put it in a battery and sell the battery?

**Mr OSTOJICH:** Yes, they will sell the battery, no problem at all—happy to do that—but the graphite and all the strategic materials that go with it, they are a lot more hesitant.

**Mr S.K. L'ESTRANGE:** What about the graphite? You say that there is no graphite in Australia; is it because geologically there is no graphite in Australia or no miners are actually looking for graphite?

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**Mr OSTOJICH:** No. There is graphite in Australia. There are known reserves somewhere; we are not quite clear about where that is, but there is no commercial activity around that. So far, the evidence is that the quality of the graphite is not battery grade at the moment.

**Mr S.K. L'ESTRANGE:** Do you see that as a critical vulnerability to Western Australia's or Australia's capacity to moving innovation forward?

**Mr OSTOJICH:** It is for the moment, but it is not something that cannot be overcome. That is one of the things we are trying to do to overcome it, which is to do research into artificial graphite. That will be a game-changer. As soon as we are able to master that, the whole circumstance changes.

**Mr S.K. L'ESTRANGE:** Who is working on that?

**Mr OSTOJICH:** The mineral CRC people who are operating at the moment. The other —

**The WITNESSES:** Is that at the ARC building?

**Mr OSTOJICH:** No. It is in the ARC building. I have lost my track of thought now.

**Mr S.K. L'ESTRANGE:** In terms of innovation in the future.

**Mr OSTOJICH:** The other mineral that is crucial to this process is cobalt. Right at the moment we know we have cobalt somewhere, but the Democratic Republic of Congo supplies upwards of 80% of that, if not 90% of the world's need for cobalt. So overcoming those two hurdles is crucial for us to go to the next stage.

**The CHAIR:** Is there some sort of exploration incentive that could be put in place to target specific minerals that are inputs into this process? Is there some sort of scope for that?

**Mr OSTOJICH:** Not that I am aware of, no.

**The CHAIR:** There is no scope for that—full stop? We are thinking of fresh ideas if this is a core input into this process that has been identified.

**Mr S.K. L'ESTRANGE:** The exploration incentive scheme does exist at the moment, so if a company has enough evidence to suggest that there might be reserves somewhere and it wants to run a project, it can bid for the exploration incentive scheme to co-partner with government on that, but you are not aware of any who is doing it?

**Mr OSTOJICH:** The incentive scheme that goes along with exploration, sure, that applies.

**The CHAIR:** But it does not target specific commodities?

**Mr S.K. L'ESTRANGE:** It can award it to a company.

**The CHAIR:** But just to a company; it has not said, "We have identified that X, Y and Z are really important commodities to our economic development"?

**Mr OSTOJICH:** It does not operate in that way, no.

**The CHAIR:** Okay.

**Mr OSTOJICH:** But if you wanted to change the complexion of the scheme, sure, it would not take very much to do that. But the exploration, I think, is one thing, and I think that we have some understanding where those things could be located in a broad sense. But the thing that is going to change that equation is the economics of actually extracting it. That is the key to it. It is knowing that it is there. We know some of it is around the place, but actually understanding the economics of it is a key issue.

**The CHAIR:** How progressed is the graphite substitute research? Is this a brand-new idea that is at the very early stages of research, or is there quite a mature body of research already in place?

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**Mr OSTOJICH:** No, lots of people have tried: the Japanese, for instance; there is some research out of the United States. Nobody has got there yet. They have got there, but not in an economically capable way, and that is really the Holy Grail—to make sure that we can do it and we can do it well. The baseline application of theory to this is that you get iron ore and you get gas and combine it and you have got graphite. It is like telling you how to play the flute by blowing in one end and moving your fingers up and down the outside. It is the same kind of thing. We know we have got that. It is that kind of minutiae and building on what is already there. So, no doubt, they are doing it. There are very good scientists and there are exceptional people that I have run across who are now going to be involved in that

**The CHAIR:** Here in WA?

**Mr OSTOJICH:** Here in WA.

**The CHAIR:** Would you please take that on notice, if you would not mind, about who is doing that and we could potentially reach out to them.

**Mr OSTOJICH:** Sure, I can certainly give you that, but this is new. This is, like, announced last Friday.

**The CHAIR:** That is fine. That would be fabulous.

**Mr S.J. PRICE:** Could I ask a question on graphite. Can graphite benefit from a beneficiation process? Is that able to be improved as a product?

**Mr OSTOJICH:** Benefit from an identification process?

**Mr S.J. PRICE:** Beneficiation.

**Mr OSTOJICH:** A beneficiation process?

**Mr S.J. PRICE:** Yes.

**Mr OSTOJICH:** I do not know is really the answer. I do not know. All I am told is that the graphite that we have, that we could have can assess to, is not quite battery grade. How you get it from that raw graphite stage into battery grade is a key question, and that is one of the things that these guys are going to be looking at. It would be fabulous if we found, like the Chinese, some ready-to-go graphite. That would be great. It would be terrific.

**The CHAIR:** Professor Beazley, you wanted to make a comment?

**Prof. BEAZLEY:** Yes, and that is to say that one of the schemes that has been very successful in Western Australia over the years, when we have a tough nut like this to crack in science, is to use the whole idea of Premier's fellowships. We look around the world for the very best person. The universities then bid to host whoever it is and their entire team, and one of their remits is to work very closely with industry. So there might be opportunities—I do not know, Joe; we have not discussed this yet—to talk to the office of science about the potential that if we could import someone and their team if we need it. It could be that within industry there is the powerhouse we need.

But if there is not, this is another mechanism to really put us in the forefront. They are very good at horizon scanning so we can actually put it in context. In the past, we have always had Premier's Fellows who have worked very closely with industry. The opportunity for people within industry to then have a post across—industry fellowships they are called. For many years now, TIAC has been strongly advocating for these. So people are working not only within an industrial framework, but also have a post at unis. That has worked very well in countries—in Britain, for example—who have industry fellows. So there could be the potential for that. I do not know whether we would need

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that, but it is a mechanism we could use, because it sounds to me very much, and I think to you, that we need extra brain power on this one.

**The CHAIR:** That is a really interesting idea.

**Prof. BEAZLEY:** I think you would back that up, too.

**Ms CLEMENT:** Absolutely.

**Mr OSTOJICH:** The allocation that was made the other day, that was announced, is \$5.5 million to a cooperative research centre, which is associated with Curtin Uni, and there are some people out there who are heading that up who have some serious intellectual horsepower and understanding of how these things can work.

**Prof. BEAZLEY:** Often a Premier's Fellow gives that real focus to it. There could be people there who will do it; but, if not, they are really a cohesive force for good.

**The CHAIR:** And I suppose as well, it is a sort of having the best and brightest brains on those topics in Western Australia would be a prime reason for a company overseas to then invest the capital here in those technologies, and —

**Prof. BEAZLEY:** Absolutely.

**The CHAIR:** — it is just about creating that critical mass, is it not, really?

**Prof. BEAZLEY:** Companies follow these leading academics. The other point is that we do not want to end up with a situation where we do not have a trained workforce to take advantage of this.

**The CHAIR:** Absolutely.

**Prof. BEAZLEY:** For example, look at waste recycling: we have had to import people on 457 visas to do it because we do not have local people here. So that breaks the cycle. It is, I think, not only important to work between industry and academe, but also to put in place these training programs so that we can really take advantage of it for young Western Australians but also from the point of view of attracting more international students here. That is one of the main opportunities I think this state has. If we are teaching relevant subjects such as this, then we again have a competitive advantage. So I think it spreads more widely —

**The CHAIR:** And another export opportunity.

**Prof. BEAZLEY:** Absolutely. So I think it spreads more widely.

**Mr Y. MUBARAKAI:** I have a quick question. It could be a lengthy answer—I am not sure—but you can take it on notice. In terms of paradigm shifts, what we have seen is that in terms of energy and to create it and store it we have seen that we are in a phase right now where we have identified, you know, lithium as a commodity that is going to enable us to create batteries for storing energy. So here we are talking about wind, water, solar and some mechanisms to create sustainable energy. To create it and then to store is the next phase of how we are going to make it sustainable. So in the storage capacity of things, we have looked at lithium. We are fortunate enough to identify that this is currently the way the market is going to trend moving forward with vehicles and whatnot. The question I have is: if today lithium is the commodity for storage, could there be another product or have we identified another technology or a commodity that could be better than lithium in storage of power? Could we make better use of that?

**Mr OSTOJICH:** There are several elements that actually have the capacity to hold and store power probably better than lithium. Two that we know of at the moment is dysprosium. I do not know whether I have that pronunciation right, but it is pretty close to that.

**The CHAIR:** You can correct the transcript if it is not.

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**Mr OSTOJICH:** And neodymium. Once again, I cannot vouch for the pronunciation. They are two that we kind of know of, and once this opens up and once the kind of thinking about this opens up from a scientific point of view, then there will be lots of testing through the periodic table that could turn up any number of things. So, it is really an economic question that has bled into a scientific area of inquiry that could throw up any number of things. That is one of the things that we really would like the CRC to do.

**The CHAIR:** And we could thought-lead. We could lead the world in this sort of thing.

**Mr OSTOJICH:** Yes, certainly. Absolutely we can.

**Prof. BEAZLEY:** And in terms of the analysis of rock, we have the very best facility in Curtin in the world. There is no doubt that the de Laeter Centre has been built around doing exactly this, and with the support of UWA through their centre for microscopy and microanalysis, we are very well placed already. We have the big toys to do this.

**The CHAIR:** That is great. We are unfortunately short of time, but —

**Ms CLEMENT:** Could I just add one more comment?

**The CHAIR:** Yes, of course.

**Ms CLEMENT:** We have been very focused around lithium and those sort of type technologies, but the other technology that is out there is more around, like, the stabilising technologies that actually controls during peak loads, and about, I guess, those control —

**The CHAIR:** The IT smarts to optimise system dispatch?

**Ms CLEMENT:** Yes, that is right. Some of those technologies are quite vital for the whole system to work. So, yes, that is just another new or trending technology that should be considered as well.

**Prof. BEAZLEY:** And if we want to be able to model that and do it successfully using the Pawsey Centre, which has our supercomputer—we just had a further investment in that—it is a great opportunity for us. So, again, this part of the infrastructure we need. One-quarter of the time dedicated on the Pawsey Centre at the moment is for industry development, so the opportunity is absolutely there, with a very user-friendly team. You do not have to know the answer; you just have to take the question.

**The CHAIR:** Yes. Fantastic. That was so interesting. I will proceed to close today's hearing.

Thank you for your evidence before the committee. A transcript of this hearing will be emailed to you for correction of minor errors—pronunciations of complex mineral compounds being one of them! Any such corrections must be made and the transcript returned within seven days of the date of the letter attached to the transcript. If the transcript is not returned within this period, it will be deemed to be correct. New material cannot be added via these corrections, and the sense of your evidence cannot be altered. Should you wish to provide additional information or elaborate on particular points, please include a supplementary submission for the committee's consideration when you return your corrected transcript of evidence. Thank you so much.

**Hearing concluded at 11.53 am**

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