

ECONOMIC DEVELOPMENT AND INFRASTRUCTURE COMMITTEE
Inquiry into greenfields mineral exploration and project development in Victoria

Melbourne — 19 September 2011

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Mr J. Law, Director, Minerals Down Under Flagship, Commonwealth Scientific and Industrial Research Organisation (CSIRO).

The CHAIR — Welcome to the public hearing of the Economic Development and Infrastructure Committee, which is an all-party parliamentary committee hearing evidence today on the inquiry into greenfields mineral exploration and project development in Victoria.

All evidence taken at this hearing is protected by parliamentary privilege. Comments you make outside the hearing are not afforded such privilege. For the record, please state your full name and business address.

Mr LAW — Jonathan Douglas Mitchell Law, CSIRO Clayton, Bayview Avenue.

The CHAIR — Are you attending in a private capacity or on behalf of CSIRO?

Mr LAW — On behalf of the Minerals Down Under Flagship, which is a part of CSIRO.

The CHAIR — And your position?

Mr LAW — I am the Director of the Flagship.

The CHAIR — Thank you. Would you like to make an oral presentation.

Mr LAW — I would, and thank you for the opportunity to present to the Committee. I have some brief comments to make, based on PowerPoint. I am happy to take questions as we go through them.

Overheads shown.

Mr LAW — I will summarise briefly what Flagships are, because I know a lot of people are not familiar with them. Around seven years ago CSIRO decided to take a much more strategic perspective on how we bulk up our R&D to take notice of the real national challenges facing the country, and three and a half years ago, I am delighted to say, minerals was considered to be one of these major challenges that the nation needs to look after, and basically there was a recognition that the benefit of industry in Australian minerals is not necessarily the same as the long-term national strategic interest.

CSIRO has nine Flagships. As you will see from the titles, all of them relate to major challenges for the nation going forward. We have Climate Adaptation, Future Manufacturing, Sustainable Agriculture, Energy Transformed, Minerals Down Under, Water for a Healthy Country, Food Futures, Preventative Health and Wealth from Oceans.

Minerals Down Under is one of those nine Flagships. It is a partnership between CSIRO, industry and other research organisations, and many state governments. Our objective is to unlock in situ resources in Australia either through new exploration technologies or new processing and mining technologies, and also to help grow the minerals services sector in Australia, which is already fairly strong.

We deliver our research through seven research themes, which are illustrated in the boxes on the diagram. They cover the value chain of the minerals industry from exploration through to mining, processing and sustainability issues, particularly related to water and energy. We have an annual budget this year of \$84 million. We have 285 effective full-time staff working on our programs, and we integrate the activities of various divisions that you see in the big box at the bottom of the diagram from all the divisions across CSIRO to build up integrated research programs that draw on cross-disciplinary science right across the organisation.

Minerals Down Under focuses on minerals mostly. It includes uranium, but it excludes carbon-related energy materials, geothermal and sequestration. Most of CSIRO's minerals-related research activities take place within the Flagship. The focus is very much on long-term national benefit, although we do work with industry partners to achieve that. It is a national partnership with industry and government, but it also has important international links with industry, government and academia around the world. We have very much adopted a triple-bottom-line approach in line with business, and we strongly believe that any policy should also adopt that approach.

Mr FOLEY — When you say that it excludes carbon-based energy, in other words you exclude coal?

Mr LAW — Yes; coal, oil and gas.

Mr FOLEY — Is that dealt with elsewhere by CSIRO?

Mr LAW — Yes, in some of those other Flagships, that is addressed there.

Basically our impact is in three areas. We are looking to grow the resource base, either through new exploration discoveries or new technologies to grow the resource base through changing costs, to grow the productivity of the industry and particularly to reduce the footprint of the industry, be it the environmental footprint, the energy footprint or simply the visual impact of the industry. We do that across a range of different commodities that are listed.

Mrs PEULICH — Are you able to tell us what those commodities are?

Mr LAW — Yes; my apologies. They are copper, nickel, lead, zinc, gold, uranium, iron, aluminium and magnesium.

Our exploration research, which is probably of more interest to this group, is focused in four major areas. The first is the development of national data infrastructure and data integration technologies so that we can share the nation's geoscience data around the world; new detection tools for exploration, which is new ways of finding ore deposits; mineral systems research, which goes to the heart of how we understand ore bodies and how they are related to regional geology so that we can focus exploration more effectively; and we have a very important component in education, technology transfer and collaboration, to make sure that our activities are well received by industry and applied for exploration success.

We have had two very important collaborations with the Victorian State Geological Survey in two of those areas. In the area of national data infrastructure, we have worked with them to deploy, with AuScope, data standards with the other surveys in Australia. We have also deployed, on a lease basis, one of our hyperspectral mapping instruments, which is the diagram on the left, which can be used to interpret the mineralogy of drill cores.

The issue of exploration success is not a Victorian-centric one. It is obviously a global issue which is of concern around the world at the moment, and it is reflected in declining discovery rates around the world and, more importantly, a decline in greenfields share of exploration. In the year 2000, approximately 50 per cent of global exploration was focused on greenfields activities. Today it is more like 33 per cent of global exploration, and that is in spite of growth in the real dollar amounts of exploration globally.

At the moment 50 per cent of exploration is focused on gold. The total non-ferrous — that is non-iron ore — materials exploration budgets will exceed \$17 billion globally, and that is an increase of 50 per cent planned for 2011 over the top of 2010. That is really reflecting the fact that people are seeing the need to spend more money to replace resources that they are having difficulty finding. That is expected to be a new all-time high and really is reflecting a changing attitude to risk in the industry. It is a very competitive investment climate.

Mr FOLEY — Does that mean there is increased investment going into finding brownfields resources?

Mr LAW — Yes, that is right.

Mr FOLEY — Can it be seen as a logical reaction to industry challenges and efficiency measures, or is it just too hard?

Mr LAW — It is a very short-term approach. It is partly driven by the mining boom and the fact that there is a short-term opportunity to make money in the industry. It is also partly driven by a recognition that the risk is much higher in greenfields domains, so particularly small companies prefer to be in low-risk domains, which tends to be brownfields. I will briefly make a few comments just on the terms of the inquiry.

The CHAIR — Everyone starts to salivate when you put that slide up.

Mr LAW — The Victorian challenges are very similar to the broader national challenges in Australia. The issues that we have identified at CSIRO relate to the perception of prospectivity in Australia and Victoria and whether it is mature or less mature. In terms of the challenge of transported cover, a significant part of Victoria and the continent is actually covered by transported sediments, which make it very difficult to know what is

underneath. Most exploration in Victoria and elsewhere (that is not brownfields) has been very shallow in nature, so we have literally only scratched the surface of the potential opportunity at depth. I have already mentioned the declining greenfields exploration investment and the declining global success rate.

These challenges also provide a major opportunity for any jurisdiction. In terms of the perception of prospectivity, if that is turned around, of course, the investment flow into exploration is likely to be quite significant. In terms of transported cover, there is effectively a new search space that becomes available if you can develop technology as a way of exploring under cover. In terms of depth, even in brownfields areas, there are tremendous opportunities to explore more effectively at depth and find new deposits. If we can turn around the declining greenfields exploration, there really are opportunities for brand new ore districts, which is really the Holy Grail for exploration. Of course, the industry is very much driven by where the success is, so if there is success in a place, the dollars tends to follow that and new investment follows in that domain.

The CHAIR — It is like going fishing where someone is catching fish.

Mr LAW — Exactly. And because of all of these factors the international competition for the exploration dollar is as strong as the commercial competition between companies. There are also a series of non-technical challenges to greenfields exploration. I have touched on ‘the perception is everything’ notion. Positive success stories attract explorers like nothing else. Everybody wants to be an elephant country. So if there is a success going on in a particular state, it really has a major impact on the way that people think about the state. It is very important for explorers undertaking greenfields exploration that they can tie down a significant land package. If there are exclusions or if it is extremely onerous to pull a land package together, then in the unlikely event that they are successful, there is always a risk that the piece that holds the ore body will not be available. People want to control the haystack, so to speak, although they are only looking for a needle.

I think there is a real issue in Victoria and elsewhere about the public understanding of the exploration risk-reward equation. There is often an expectation that if exploration is going on, there will be a mine in a particular area, and that is clearly not the case. Exploration is actually not a terribly successful business in terms of the number of drill holes versus the number of discoveries. Industry needs the certainty to proceed, but it is actually very unlikely that it will proceed in any one particular area.

We within the Flagship think about resource discovery as a partnership, and the strength of this partnership I think really goes to the heart of how successful exploration in a particular jurisdiction is. We see that the innovation sector, CSIRO and the universities need to link very closely with the national surveys or the state surveys and Geoscience Australia and the explorers. Innovation provides the tools, surveys provide the information and explorers are actually the ones who go out there and find the ore body. So if you do not have that triangle operating effectively, exploration is likely to be less effective.

The geology of each domain is unique, and it is quite possible to tailor a strategy to focus on the geological endowment that a particular terrain has. I wanted to draw your attention to the diagram on the right, which shows the strategically important commodities around the world and the nations that control them. You will see that China controls 27 and Australia controls 4. Those 4 are lithium, zirconium, alumina and titanium. We are a significant player in the supply of those materials. I particularly wanted to note antimony, which is actually considered by the British Geological Survey to be the no. 1 global supply risk. Victoria’s geology is particularly favourable to antimony, and it is very closely related to our gold endowment, so there is an opportunity for us to take leadership there.

Mr FOLEY — Can you share with us non-geological types what antimony is?

Mr LAW — It is a metal. It is found as a metal sulphide. It is often found spatially with gold and arsenic, and the style of gold deposit that is common in Victoria often has a significant amount of antimony in it.

The CHAIR — It is used for?

Mr LAW — It is used for fireproofing, electronics and a range of other industrial applications.

Mr FOLEY — To stop these things bursting into flames.

Mr LAW — Yes.

The CHAIR — It is a good thing then.

Mr LAW — Other strengths that the State has, of course, are the State Geological Survey, a wonderful knowledge bank that has a global reputation, and the scientific infrastructure that we have in the form of our universities, which have strong geoscience departments, the CSIRO and the Flagship and the Australian Synchrotron. There is a wealth of scientific knowledge available to deploy as well. There is also a range of broader industry challenges which do not relate directly to exploration but which have a very important bearing on the minerals industry more generally. We at MDU think there is a great opportunity to take advantage of some of these domains outside of mining. They all relate to mining, but because Australia is booming in terms of mining there are all these other opportunities which are related but different, which are complementary and provide an opportunity for the state.

Mrs PEULICH — Are they in order of priority?

Mr LAW — No.

Mrs PEULICH — Looking at that, which would be the top, say, three or four factors that pose the more significant challenges?

Mr LAW — They are all extremely important challenges. It really just depends on what strategy the State was interested in taking in terms of taking advantage of the mining industry.

Mr FOLEY — And in CSIRO's role in terms of the Flagship approach do you touch on these broader public policy areas or do you stick more to the knitting of the key aspects?

Mr LAW — We touch on the scientific aspects of all those. We do not comment on the political implications of those, but we have research programs that underpin each of these domains.

Mr FOLEY — Including the industry stuff, automation and safety, as well?

Mr LAW — Yes, absolutely. One of our research activity themes is around mining automation and safety in the mining industry.

Mr FOLEY — When you say regional sustainability, we are talking about sustaining communities and whole regions, given that so much mining is regionalised. Do you think about that much broader public policy?

Mr LAW — Yes, we do. As part of our social research in the Flagship we have a program that looks at the impacts of the industry in communities, the long-term sustainability of those communities, the attitudes of the communities to mining and the attitudes of communities to technologies. I think that is a fundamental challenge for industry: the perception in the community at the moment.

Mrs PEULICH — With the competing land use, is that ostensibly a comment on the agricultural uses versus exploration or mining?

Mr LAW — Yes. I will make a few more comments on that later. It is largely agricultural, but there are other land uses in rural communities. Basically anywhere where mining is co-located with another activity there is often a tension, be it related specifically to the land or the cost of skills or the impacts on the community that are often unintended impacts. I mentioned before the opportunity to link any strategy to geology. Clearly the mining industry, largely for commercial reasons, has tended towards large low-grade deposits in terms of the majority of production around the world. It is partly because of the fact that cost savings for high-production rates are becoming more important and partly because of the fact that we have not been very successful at finding high-grade deposits. There has been this inevitable trend towards low-grade deposits. That means very high capital costs up-front and big investments by mining companies. In order to do that they really require certainty around the resource. One of the challenges that Victoria has, particularly for gold, is that many of our gold deposits are quite nuggetty in nature. It is quite difficult to predict exactly how much gold is contained and exactly where that gold is, which makes it difficult to make those capital investments. So there is a particular challenge for Victoria in terms of gold.

Mrs PEULICH — Nuggetty, as opposed to finer particles?

Mr LAW — Right. So you get sort of two end members — disseminated gold, which is quite easy to predict because it is the same more or less everywhere, and nuggetty gold, where you get a large concentration of gold and then nothing for a while and then a bit more.

So that makes it very difficult to know what you have, especially for complex vein geometries, which are also quite common in Victoria. I think that factor in particular has been quite important in some of the failures of the gold industry in Victoria over the last 10 years or so.

The other thing to bear in mind is that the very fact that a large part of Victoria's early urbanisation was actually driven by the goldmining industry means that the opportunities in gold tend to be co-located where the communities have developed, so there is a — —

Mrs PEULICH — Competing land use.

Mr LAW — Yes. In other jurisdictions, and in Victoria, state initiatives I think have been fantastic in attracting and making exploration effective. In Victoria we have had the Rediscover Victoria program, which ended in 2011, and Gold Undercover, including co-investment in drilling. So the opportunity for exploration really relates to the fact that we have what we have in Victoria — that is a given — but what we do with it and how we unlock it is really where the opportunity lies.

One of the approaches that we have taken within the Flagship is to look at exploration technology packages, as we call them. Our idea there is to take exploration tools, the best exploration data and knowledge of a particular geographic area and package them all up into something that is much more attractive for the exploration industry than any one of those components. So there is an opportunity to build a strategy based on the strength of Victoria, which to my mind would include geological differentiation, human capital, the sociopolitical infrastructure in Victoria and the natural partnerships we have with the State, industry and innovation sectors.

On the roles of government, I think the absolutely most important thing that any government can do is to send a very clear message that they are open for business in minerals. Once the skills and the mining infrastructure are lost in any jurisdiction — and we have seen this in North America — it is actually quite difficult to get it back. Community expectations change; it is quite a difficult thing to turn around. We have a very strong geological survey with a good track record. Precompetitive data in Victoria and Australia in general is amongst the best in the world. I think we should maintain that because that is really the engine room to attract investment and it goes to the heart of the perception issue of where is a good place to be and where is not. So the exploration incentive schemes, including the Victorian ones, have been very successful in Australia. I think they have made quite a difference.

We have worked with geological surveys around Australia in a range of different ways. I have listed a few examples there. One was an airborne mapping program with PIRSA. We do groundwater surveys with the Geological Survey of Western Australia, and we have had uranium mineral systems studies under way with various states, to better — —

Mr FOLEY — Mineral systems studies — what are they?

Mr LAW — What that means is that we study the geological environments of the ore body to try to come up with predictive indicators of how to find another ore body.

In terms of unlocking the value for Victoria, I think it is very important that there is real and perceived distribution of benefits from the mining industry through the broader community. The two-speed economy at the moment is really driving quite a negative perception around the mining industry, which is very unfortunate. The industry and mining jurisdictions really need to paint a sustainable vision that goes beyond simply mining to the broader economy.

I think it is very important that we understand our state's geology, not only from the point of view of minerals but because it is really home to all our activities, be they in minerals or energy, geosequestration, geothermal or geohazards. The better we understand our planet I think the better off we are to manage the broader economy.

Mr FOLEY — What is a geohazard, Jonathan?

Mr LAW — Earthquakes, landslides; foundation quality.

There is a opportunity everywhere, I think, to integrate mining with the broader economy. We see sort of a virtuous triangle between the mining industry, research and development partners, and service providers and equipment manufacturers. To be a player in the mining industry, you do not actually have to do any mining. You may well play into the R&D sector or the commercial services or manufacturing sector. So there is a broad opportunity in Australia I think in general to capture that market.

Mrs PEULICH — Does that need to be localised? Is proximity a factor?

Mr LAW — It is not a factor in a lot of those areas. In fact the digital economy is making it much easier to de-localise it.

The CHAIR — Thanks, Mr Law. Are you happy to take some questions?

Mr LAW — Yes, certainly.

The CHAIR — I might lead off, then. One particular area that interests me a great deal — and you seem to come from an area that might be able to inform that situation — would be: what sort of advances are we making where we have been able to map deeper into what Australia has — and what Victoria has in particular — as far as minerals deeper down are concerned?

Mr LAW — It is one of the big challenges that we actually have not made an enormous amount of progress on. The Australian Academy of Science recently came up with a series of priorities — some of which I think were listed in the written submission that I have provided — in terms of what we could do to actually improve on that situation. There were a number of quite simple, easy wins that were put on the table. As I recall, the first one was to do with actually knowing how thick the cover is. Once you have a metre of cover, you may have a metre or 100 metres; it is very difficult to know. Mapping technologies to be able to predict how thick that cover is and then choose appropriate tools to explore through it would be a really easy win and a strong advantage.

We are also working on a range of geophysical tools to facilitate seeing through the cover. There are new magnetic technologies in particular that are more sensitive and able to see more deeply. That will be important. Lastly, I think drilling is very important. I think in geology it is important not to get too smart. It is very difficult to predict geology a long way from known information, so a drilling program that provides basic geological information makes it much easier to use the other information to extract a better knowledge base from it.

The CHAIR — I am interested in the cover you talk about. Can you explain that in a little bit more depth — excuse the pun?

Mr LAW — Sure. It really occurs probably in three ways. One is the recent river sediments that often cover large parts of Australia, particularly central Australia, some of the more desert regions. You have these recent river sediments that just obscure all the geology that is underneath. The second type of cover is really the regular, which is the weathering that changes the nature of the rock formations as they outcrop. It can fundamentally change the chemical composition; it can leach out the metals that you are looking for — it makes the rocks look different — so it is a kind of an obscuring type of cover. Lastly, there are the younger sedimentary formations that overlie the ore-bearing horizons in many jurisdictions. In Victoria, the Murray Basin would be a good example. The Murray Basin overlies a lot of older geological formations that contain mineralisation, so you have to look through that before you can explore the bedrock that lies underneath. There is no reason to expect that that bedrock is any less prospective than the part that sticks out. We just do not know.

Mr SHAW — There was a graph you showed before — a pie graph — that had China owning 27 of the main minerals and Australia 4 of them. In those 4, does Victoria have any of those? That was Australia, wasn't it?

Mr LAW — That was the whole of Australia, but in fact all of them, except lithium and aluminium, are actually available in Victoria, and that is through the mineral sands deposits. Titanium and zirconium, I think, were two of them, and they are related to the heavy mineral sands in Victoria.

Mr FOLEY — Jonathan, I was going to ask you about that mineral sands stuff, because in your written submission, in the prospectivity part of our terms of reference, you talk about the deep-lead gold resources and the fine-grained Murray Basin mineral sands deposits as really our standout opportunities. Have I read that right?

Mr LAW — I would not call them the standout opportunities; I would say they are significant opportunities that are not being addressed at the moment.

Mr FOLEY — Okay. Focusing firstly on the fine-grained Murray Basin mineral sands deposits, which Geoff just touched on there, what would you see as holding us back compared to, if you like, a best practice model for that particular sector? Are they the same issues that apply to that sector, or are there particular issues for the mineral sands sector?

Mr LAW — There are particular issues related to the mineral sands sector. A lot of these deposits are actually already known, and that is why they are an easy opportunity. The resources are well defined. The problem as I understand it is that because they are very fine-grained minerals compared to some of the other alternative deposits in Australia, they would be quite difficult to process effectively. I think there is a process technology constraint on why companies are not developing. It would be more expensive to develop those.

Mr FOLEY — In the role-of-government approach you were touching on there, where do you see the role of government in that particular sector? If it is, as I am gathering, down the end of the processing problem, what is the role of government in that particular sector?

Mr LAW — One of the possibilities we considered early on in the Flagship history was to have a co-investment strategy between CSIRO, industry — which holds the deposits — and governments to look for suitable processing opportunities.

Mr FOLEY — Such as? Was there any work that has come to a conclusion in that area?

Mr LAW — No, there has not been significant work there that has come to a conclusion, but there are a couple of strategies that could be adopted to try to explore that. The first important thing to do is to understand the size distribution of the minerals and the physical properties of the minerals as they exist in those ore bodies and then look for process solutions that will take advantage of the physical differentiation between the minerals.

Mr FOLEY — I do not want to hog this too much, but given that that falls across the Murray Basin and the different state jurisdictions that therefore occur, in that sector how important are the different state approaches to regulation, access, exploration et cetera to determining where the investment dollar for exploration goes? Why does someone go to Victoria, New South Wales or South Australia and not their competitors?

Mr LAW — I am not an expert in mineral sands, but it would be my personal view that the state jurisdictions are less important than the geology of the ore bodies. I think people would see the opportunity as being reasonably similar in all of those domains. I am not aware of any specific issues between states that would drive the choice.

Mr NOONAN — If I may, Jonathan, you were talking a fair bit about the value of precompetitive data, and I think I recorded that you indicated that Victoria or Australia are among the best in the world in relation to providing datasets. It seems like that is the base level information that goes into the market. In some areas it is not until you get to the drilling components where you start to get a stronger sense about what might be under the crust, or whatever the terminology is. I note also in your presentation you talked about the Gold Undercover program. I see that the Western Australian Government and I think the South Australian Government also have co-funded exploration drilling programs. Could you just comment about the value, as you see it, of those drilling programs, given that they seem to be the next level, if you like, of determining what might be available in relation to the greenfields exploration process?

Mr LAW — Yes. Look, you are absolutely right. The precompetitive data in its own right is important, but it has reasonably limited value because it does not provide any small-scale specific targets. There are two ways to add to that. One is fundamental geological studies that integrate the information from the various datasets; they all provide different but complementary information. I think the Victorian survey has been particularly good at integrating those datasets and using that information in things like modelling of geological processes to

try to predict how that information can be used to predict the location of ore deposits, but the one you allude to is probably more important, and that is drilling information. We learn a tremendous amount from drilling. Every borehole that goes down in the greenfields area provides information whether it finds an ore deposit or not. What it does is add value to the whole area, and it makes the interpretation of those remote datasets much better in those areas. As you move away the uncertainties grow very quickly.

The CHAIR — Do you always have access to that information?

Mr LAW — The drilling formation?

The CHAIR — Yes.

Mr LAW — Yes.

The CHAIR — How does that come to you?

Mr LAW — It does not come directly to CSIRO. What it does is go to the state geological survey, and that is eventually accessible to anybody who wants to look at it. I am not sure in Victoria whether that is only after the land package is released by the explorer or whether it is available immediately.

The CHAIR — That is a requirement of the licence, is it?

Mr LAW — Yes.

Mr NOONAN — If I might, the WA Government is committing \$6 million for the calendar year next year to assist in drilling. Have you looked at the value of that in the past with other state governments or jurisdictions investing in this and the outcomes that are achieved from the co-funding, if you like, of the drilling investments or drilling exploration programs that are put up by various jurisdictions? Is there anything we can look to as a committee which will point to the value of these, because the value of these is obviously what comes after this sort of early program?

Mr LAW — I think South Australia probably led the charge in terms of developing these concepts. Certainly on an anecdotal level I know they have had some really impressive successes in co-investing with industry in drilling that has actually turned out to snag an ore body, so I am pretty sure it is probably the best jurisdiction to have a look at.

Mr NOONAN — That is anecdotal. Is there nothing measured?

Mr LAW — I am sure there are summaries of those outcomes, but I am just not familiar with them.

Mrs PEULICH — On top of the drilling, you mentioned earlier that you looked at research, processing and footprint as being the three areas where we need to do things better. On top of that, what else is required if Victoria is going to be better positioned to achieve the sorts of successes that obviously we will need to change that prospectivity, and where would government money be best invested? Is it in the research, is it in processing or is it in the footprint in terms of positioning?

Mr LAW — Can I make a comment on a personal basis, because it would probably not be a formal Flagship perception? I think the no. 1 challenge for Victoria is the perception around how welcome the industry is in Victoria. I think that holds back a lot of investment. Beyond that I think it is all about the geology of Victoria and whether the State sees itself as a mining state, a services state or a manufacturing state relative to the mining industry and how it wants to integrate its minerals business with the rest of the earth resources business, which as I said is geothermal, energy and carbon sequestration and all of those activities. I think it would be far better to take a global perspective of earth sciences and think about how important minerals are within that perspective and how important production is within that perspective or whether or not the state wants to take an alternative approach to the opportunity.

Mrs PEULICH — Given your answer, what top three things can we do to change that perception?

Mr LAW — Probably a clearly articulated resource strategy for the State that clearly has support and is well articulated and well presented to the media. There is a community issue in Victoria where I do not think people

understand, as I said earlier, the broader value in the exploration business that comes out of the mining industry. They see it as a threat to their lifestyle, particularly in Victoria, so there is an enormous public education angle to the whole thing. The third one would really be the question: 'What do we have in terms of resources, what could we find in terms of resources and what should we do to unlock those?'. That comes back to the triangle I showed before, which is precompetitive information, a strong research base that can interpret that information and make it available in terms of knowledge rather than data, and a mining industry that is prepared to invest. I think those would probably be your three things.

Mr SHAW — What closed the doors as far as the industry is concerned? We just talked about how we can open the door, but what actually closed it? How long ago did that happen?

Mr LAW — I am probably not very well placed to answer that question because I have lived in Australia for only 10 years. It is probably something that started to evolve before I arrived in Australia. You probably need people who are better able to comment than I am.

Mr FOLEY — You talk about the broader industry, the innovation and the services. Are there particular hubs of best practice around how that works internationally and the role of government? I think you spoke about our research, our universities, the Synchrotron and a whole range of services that support the industry not just in Victoria but in Australia. Given the globally leading players we have in this town, how important is it to the future of the Australian mining sector, let alone the Victorian mining sector, for that to be humming along in Victoria? Does your Flagship project look at what can be done to facilitate greater investment and activity in that part of it, as opposed to the greenfields digging and exploration?

Mr LAW — Our Flagship does consider that. I think I mentioned that we have two broad goals. One is unlocking Australia's natural resources through technologies, and the other is to grow the services sector in Australia, which is already a booming sector. The reason for doing that is that the mining industry by its very nature is a depleting industry. It does not matter how long it lasts; it will not last forever in a particular domain. The high-grade resources will eventually be depleted. That is one of the challenges the industry has in terms of not being perceived as fly-in fly-out and value-adding but actually contributing something in the longer term to the community. I think it is very important for any jurisdiction to have some sort of vision for what happens next after a particular mining domain.

I think there are two opportunities. One is in the services and manufacturing sector, specifically related to mining, be it making trucks or diggers or providing services or software to the industry. The other is better integrating the value chain from delivering a mineral product through the manufacturing sector to a variety of other products.

Mr FOLEY — Such as? How would that latter set work?

Mr LAW — For example, the minerals industry might produce aluminium, but then there might be a whole suite of manufacturing processes that take that aluminium in different forms and turn it into car wheels, aeroplane wings or other materials where real value is added.

Mr NOONAN — Geothermal is not part of your Flagship. Is that part of another Flagship out of the nine?

Mr LAW — Yes. The Energy Transformed Flagship has activities in geothermal.

Mrs PEULICH — I think you have identified the negative perceptions of mining as a significant obstacle. Is that predominately based on the uninvolved layperson seeing open-cut mines and brown earth — this negative perception of mining companies extracting everything they can without rehabilitation — and not understanding perhaps that the vast majority of explorations lead to nothing and can be rehabilitated very easily with very little degradation of the natural environment? Is that what you are getting at?

Mr LAW — That is a big part of it. In the last few years I have actually seen quite a significant shift in what is driving community sentiment. In recent times in the media there have been a lot of comments about the two-speed economy. Things that get talked about are the role of the mining industry in impacting on foreign exchange rates and what that means for the manufacturing industry, also the skills shortage and the cost of employing skilled people in other industries versus the mining industry, which is being perceived as being particularly rich, and the historical fact that mining companies come as good and bad and big and small. Some

people have done it well; other people have not done it well. There have been some legacy issues where you would justifiably be fairly unhappy if it was in your backyard. As you say, the backyard issue is a very important one. I think people would prefer not to have big industry of any type closely co-located with them.

Mr FOLEY — Unless they work in it.

Mr LAW — Unless they work in it.

Mrs PEULICH — Is there any way that that can be addressed? Are there examples where the rehabilitation has been effective?

Mr LAW — There are. I will give you an example from South Africa, which I am more familiar with. The mineral sands industry in South Africa has a fantastic reputation. They mine in coastal beach sands very close to the very scenic coastline, and you cannot tell the difference when they have been and gone. They revegetate and fill in the holes. It is very professional and takes about 15 years for the whole thing to be rehabilitated. They are moving forward with the process. There are very good examples of rehabilitation.

Our view in the Flagship is that for the future of mining low-impact technologies will be important. Rather than fixing up fairly significant problems, if there are technologies that can reduce the impact, I think there are tremendous benefits going forward. It is a very exciting time in terms of technology, with new sensors, new communication devices and automation becoming that much more dynamic and really starting to get deployed in industry in all sorts of ways. The industry may be very different in the next 20 years, and that is why there are these opportunities to grasp those new technologies and turn them into something that is complementary to mining but potentially different. There are technologies like in-situ leaching, where you do not actually dig a hole but just use a chemical to leach out the mineralisation, and automated mining, where you are doing the mining and processing underground so that you do not have the footprint. All of those things are potentially important.

The CHAIR — Thank you very much. The evidence you have given will become public evidence at some point shortly. Within the next couple of weeks you will receive a transcript, and you can make alterations to any typographical errors but no changes to the substance. On behalf of the Committee I thank you very much for what was a very professional presentation.

Witness withdrew.

